University of Arkansas
System Division of Agriculture
NatAgLaw@uark.edu | (479) 575-7646

An Agricultural Law Research Article

Owning the Secret of Life: Biotechnology and Property Rights Revisited

Part I

by

Kojo Yelpaala

Originally published in MCGEORGE LAW REVIEW
32 MCGEORGE L. REV. 111 (2000)

Owning the Secret of Life: Biotechnology and Property Rights Revisited

Kojo Yelpaala*

Dancing around the fire may contain it but does not extinguish it.

TABLE OF CONTENTS

I. INTRODUCTION 112

II. BACKGROUND OF THE BIOTECHNOLOGY INDUSTRY 118

III. HISTORICAL AND CONCEPTUAL BASIS OF PROPERTY 124
A. *The Attributes of Property* 124
B. *Roman Law Classification of Property* 131
C. *Summary* 136

IV. POLICY JUSTIFICATIONS FOR PROPERTY RIGHTS 137
A. *The First Occupancy Doctrine* 137
B. *Judeo-Christian Property Concepts* 138
C. *Locke's Labor Theory of Property* 144
1. *Locke's Assumptions and Operating Premises* 146
2. *Substance of Labor Theory* 149
3. *Labor Theory and Ownership of the Human Body* 154
4. *Summary* 160
D. *Utilitarian Theories of Property in Biotechnology* 161
1. *Traditional Utilitarianism* 161
2. *Traditional Utilitarianism and Property Rights in Biotechnology* 162
a. *Monsanto and the Corporate Strategy for Dominance in Biotechnology* 165

---

* Professor of Law, University of the Pacific, McGeorge School of Law; LL.B (Honors) University of Ghana, 1970; M.B.A. Bowling Green State University, Bowling Green, Ohio, 1977; M.Sc. University of Wisconsin-Madison, 1979; S.J.D. University of Wisconsin-Madison, 1985.

I wish to thank Molly Mugglebee who provided excellent research assistance, Doug Bragg for his excellent editorial assistance, Evelyn Posamentier, Louise Roysdon, Susan Van Syckel, and the reference library staff for being totally responsive to my sudden and constant need for information for this project and for going the extra mile in locating and providing library resources. I am also thankful to the McGeorge School of Law Summer Research Fund for financial support. I am indebted to my colleagues for comments and suggestions provided at a faculty colloquium where the ideas in this article were first presented.

i. Monsanto and the Corporate Strategy 166
ii. Monsanto and the Terminator Seed Controversy 171
iii. Monsanto and the Case of the Escaped Seed 174
3. Summary 179
E. Economic Utilitarianism 180
1. Economic Utilitarianism and Property in Biotechnology 182
2. Summary 186

V. TOWARD A HIERARCHY OF NORMS IN PATENT POLICY 186
A. Historical Overview of Patent Policy 186
B. Survey of Current Patent Policy 190
C. Hierarchy of Norms for Patentability 193
1. Norm 1: That Which Cannot Be Owned Is Not Patentable 194
2. Norm 2: That Which Can Be Owned May Nevertheless Not Be Patentable 196
a. Specific Exclusion 196
b. Exclusion Through Patentability Criteria 198
3. Norm 3: That Which Is Patentable May Nevertheless Not Be Patented on the Grounds of Morality or Public Policy 200
a. Historical Overview of Public Policy 201
b. Public Policy in United States 203
c. Defining and Adopting the Public Policy Exception 204
d. The Public Policy Exception and the Terminator Seed 208

VI. THE INCENTIVE TO INVENT AND THE EMPLOYMENT CONTRACT 210
A. Summary 212

VII. RETHINKING THE POLICY OF ACCESS—THE USUFRUCT TO THE RESCUE? . 212
A. Summary 216

VIII. CONCLUSION 217

I. INTRODUCTION

As we stand at the dawn of a new millennium, no subject seems to challenge the very essence, or *fonds et ergo* of, and policy justifications for, property as does biotechnological inventions, discoveries, or processes. At no time has the demand for a regime reassessment and a return to first principles been so pressing as now.[1]

1. With the systematic and piece by piece decoding of the genetic code of nature, serious questions are raised about whether the discoveries of nature's blue print should be the subject matter of a private property regime. Indeed, the implications of putting such discoveries and inventions within the property regime are so monumental

The question of whether biotechnological discoveries or inventions should be protected as property brings to the forefront some of the eternal policy issues that have eluded philosophers, jurists, and theologians for hundreds, if not thousands, of years. The concept of property in western legal systems emerged independent of state action and after centuries of intellectual and philosophical debate carried on through opposing pamphlets, religious disputations, and intense commentaries among schoolmen.[2] With its origins and creation occurring independent of the state, the concept of property acquired the attributes of fundamental and inalienable rights insulated from the power of the state in the form of constitutional protections.[3]

On the other hand, the notion that ideas, however developed or expressed, can be the subject of private property rights is not only recent in origin but also was not distilled from any intense intellectual or philosophical discourse on the nature, scope, or policy justifications for such rights.[4] The concept of property in ideas owes its existence to the state or to legislative fiat and therein lie some risks. Whereas the

---

that a new regime has been suggested as necessary. *See* LESTER C. THUROW, BUILDING WEALTH, 116-129 (1999) [hereinafter BUILDING WEALTH] (arguing that the current intellectual property regime cannot address the needs of the biotechnology industry); Dale B. McDonald, *Who Owns Nature?*, FARM INDUSTRY NEWS, Mar. 1, 1999, *available in* 1999 WL 13820412 [hereinafter McDonald] (discussing the nature of the misfit between biotechnological advances, the current intellectual property system, and the confusion that has arisen over ownership issues). For an illuminating article that catalogues the problems of the current intellectual property regime with respect to biotechnology and the difficulties of trying to resolve them with traditional techniques, see Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998) [hereinafter Heller & Eisenberg].

2. An assertion that the nature and origins of property rights are in natural law or divine law, which were both superior to positive law, necessarily put the creation of property rights outside the scope of the state. *See* Boudewijn Bouckaert, *What is Property*, 13 HARV. J. L. & PUB. POL'Y 775, 790 (1990) (tracing the history of the intellectual debate over the concept of property in Europe and the role of natural law theories in that history); *see also* BRIAN TIERNEY, THE IDEAS OF NATURAL RIGHTS (1997) (devoting Chapter 6 to a discussion of a history of property and the disputations within the Catholic Church).

3. In a discussion of natural law and social contract theories, W. Friedmann addressed the role and importance of private property in the relationship between the state and the individual. In particular he noted that Locke placed the individual in the center of natural law as superior and immutable by positive law. But property rights are part of the inalienable natural rights vested in the individual, which must be protected by the state as part of the duty of government. The government holds its powers in trust with the obligation to protect the rights of the people. *See* W. FRIEDMANN, LEGAL THEORY 123 (5th ed. 1967); U.S. Const. amend. V (providing thus "nor shall private property be taken for public use without just compensation.").

4. The notion that ideas could be the subject of property rights is recent in origin is not disputed. While there might be some signs of property rights in ideas in 15th century Venice, it was not until the 19th century that the subject received active intellectual attention. In comparison to the development of property rights, this is quite recent. *See generally* Bouckaert, *supra* note 2 (tracing the origin of property rights in ideas in Europe to 19th century writers, and arguing that intellectual property is not entitled to any presumption of validity because it was not the result of centuries of active intellectual discourse); AUGUSTIN CHARLES RENOUARD, TRAITE' DES DROITS D'AUTEURS (1838) (examining the history of copyright and copyright legislation prior to and after the printing press); PIERRE RECHT, LE DROIT D'AUTEUR, UNE NOUVELLE FORME DE PROPRIE' (1969) (arguing that the real basis of copyright is unstable, and providing a historical account of copyright in Europe and the United States dating back to the 16th century). In the United States, the most vocal advocate for property rights in ideas was Lysander Spooner, who in 1855 advanced a theory for property rights in ideas and then discussed it against a series of objections that might be raised. *See generally* Lysander Spooner, *The Law of Intellectual Property*, THE COLLECTED WORKS OF LYSANDER SPOONER VOL. 3 (1971).

traditional concept of property appears to operate as a check on the power of the state, property in ideas appears to be at the mercy of the state. The state determines which ideas may be included or excluded from the regime of private property. The state also determines the nature and scope of those property rights. However, does the state have total and unrestricted powers in the creation of property rights in ideas? Can the state decree that any and every type of idea be proprietary. Or, are there ideas that, because of their nature or importance to humanity, should not be the subject of private ownership and, therefore cannot, be the subject of any legislated property rights? In other words, might there be certain things, including ideas, that are irreversibly in the public domain as common property of all humanity? These questions are particularly important because the exercise of the legislative powers of the state in this matter does not benefit from centuries of evolved and mature debate on the subject. Nor is the conduct of the state always motivated by the best interest of the society or humanity. Thus, legislation dealing with the proprietary nature of ideas may be too limited, short sighted, ill-advised, or even subversive of the fundamental needs of humanity.

The concerns expressed above become increasingly important in the case of biotechnology. The strategic mission of biotechnology is the decoding and manipulation of the secrets of life itself to achieve various objectives. The question is whether biotechnological inventions or discoveries in the form of genetically engineered new life forms, genetic materials, products of biotechnological processes, including various organisms, qualify as, or should be, the subject of private property rights. By property rights, we are not referring to questions of the patentability of biotechnological inventions and discoveries and the ensuing protection generally accorded patents. Our inquiry is of a much more fundamental nature, as it raises the issue of whether there is an independent basis for treating ideas as property. Property rights created by the state under a patent statute are not necessarily conclusive of the proprietary character of the ideas involved, nor of the power of the state to create those rights. Since biotechnology is concerned with life itself, certain ideas might be beyond the scope of property and legislation.

Moreover, unlike other forms of property, or property based on other inventions such as machines or equipment, biotechnological discoveries involve the very essence of living organisms, including that of human beings. The ownership of a chair, or the technology for manufacturing a combustion engine, does not exclude another person from owning a different chair or a different combustion engine technology. In the case of biotechnological inventions, the ownership of genetic discoveries and inventions does not necessarily leave open the possibility of ownership by others. Biotechnological inventions are ideas based on basic scientific knowledge. There might be only one pathway within a genetic discovery, or invention, and the ownership of such a pathway might foreclose ownership by others and limit access to ideas.

The successful cloning of Dolly, the sheep, and other animals[5] only raises the question of whether the cloning of human beings might not come sooner than one might have foreseen.[6] Moreover, since the scientific investigation in biotechnology goes to the essence of life itself, it is quite possible that someone will uncover the secret of creating human life de novo, and the question of conferring property rights on that person will carry with it horrendous theological, social, political, and ethical implications.[7] *If property rights are granted to the creator, the property regime would then have helped us create a human "demi-god" in the inventor.* The history of the world has amply demonstrated that the acquisition of power, short of that of God, has often been abused by human beings. One therefore ought to be concerned

---

5. *See Whatever Next?*, THE ECONOMIST, Mar. 1, 1997, at 79 (describing the cloning of Dolly the sheep and the transgenic genetic engineering).

6. Recently, Professor Liam Donaldson, Chief Medical Officer of the United Kingdom, and the Donaldson Committee issued a report which recommended that stem cells research and therapeutic cloning be allowed because of the importance of embryonic stem cells in the search for the treatment of certain diseases, such as Parkinson's disease and Alzheimer's disease. The Donaldson report touched off a debate in the U.K. about the question of cloning human life forms. For newspaper discussion of the report, see Rosemary Bennet, *Embryo Research Law to be Relaxed*, FIN. TIMES, Aug. 11, 2000 (announcing the recommendation of the Donaldson Committee that the law should be amended to allow research in stem cell to be harvested from early stage embryos); Clive Cooks, *UK Moves Closer to Human Embryo Cloning*, FIN. TIMES, Aug. 16, 2000 (explaining that the ban on reproductive cloning will stay in place but the UK government will ask Parliament to vote on whether research in stem cell and therapeutic cloning should be legal); Editorial Comment, *Say Yes to Cloning Research*, FIN. TIMES, Aug. 16, 2000 (In support of the Donaldson report, the Editorial offers explanations of the potential benefits from allowing research in embryonic stem cell research and therapeutic cloning); BBC News, *MPS Divided on Cloning*, BBC NEWS, Aug. 16, 2000 (discussing the ethical concerns over cloning and the division among members of Parliament). *Cloning Report Prompts Ethical Debate*, BBC NEWS, Aug. 16, 2000 (discussing the various ethical positions taken within the medical community and in Parliament over the issue of stem cell research and therapeutic cloning); *Cloning to Beat Genetic Diseases*, BBC NEWS, Aug. 16, 2000 (explaining the techniques of stem cell research as not exactly cloning); and Clive Cooks on, *The Birth of Regenerative Medicine*, FIN. TIMES, Aug. 18, 2000 (discussing the importance of therapeutic cloning and the lack of uniform national policies or action on this issue in the EU and raising questions about the use of adult stem cells as opposed to embryonic cells). But there appears to be some competition on the issue. Just when the Donaldson report and its recommendations were released, there was a change in the rules in the U.S. rules on embryonic stem cell research. *See* Nicholas Wade, *New Rules on Use of Human Embryos in Cell Research*, N.Y. TIMES, Aug. 24, 2000, at 1 (discussing the announcement by the National Institute of Health that federally financed funds would now be made available for research in human embryonic stem cell research. Previously, such research, while not prohibited, could not be federally funded. President Clinton explained the change in position as based on the staggering benefits that could be derived from the new rules. As might be expected, the announced rules drew fire from pro-life and anti-abortion advocates, who believe that human embryo stem cell research is illegal, immoral and unnecessary.). The seriousness of the potential for cloning humans is manifested by a patent which was perhaps "inadvertently issued" by the European Patent Office for cloning life forms, including human life forms. The problem came in the description of the patent, which was not limited to non-human cloning. It is expected that the European Patent Office will modify the patent. *See* Deborah Hargreaves, *Cloning Patent to be Modified*, FIN. TIMES, June 26, 2000.

7. The idea of creating life de novo is not far fetched. Scientific research currently underway is investigating how life might be created from scratch by shifting through the genes of bacteria to find the elements absolutely necessary to life. *See* Ronald Kotulak & Jeremy Manier, *Scientists Trying to Sort Genes to Create New Life: Fears Over Ethics, Weapons Put Firm's Research on Hold*, CHI. TRIB., Dec. 10, 1999, at 1; Zone: N (discussing the research in creating life de novo and raising questions about what life is and whether within the context of religion human beings should play God).

about the implications of creating a human "demi-god," substantially driven by the property regime.

It is reported by scientists that about 98% of human DNA is shared by other animals used in various forms of scientific experimentation and genetic manipulation.[8] With transgenic genetic engineering, further policy considerations are raised about the desirability of creating property rights in biotechnological inventions. Should we draw a distinction between human biotechnological advances and those of their close cousins, and, if so, what would be the rational scientific basis for the distinction? Moreover, biotechnological inventions involve many issues that further complicate the policy considerations in conferring property rights on them. Biotechnological discoveries involve knowledge, information, data, ideas, and the process of scientific-tinkering and manipulation of various genetic materials. Scientific knowledge, information and data are generally not considered to be property, and their non-proprietary characteristic serves an important function of facilitating the advancement of knowledge in society.

Because of the significant implications of conferring property rights on biotechnological inventions and discoveries, it might be beneficial to return to the origins of the concept of property. Such a journey back should inform, but not necessarily dictate, the policy considerations and choices to be made on this important issue today. The search for guidance in history might be most fruitful if the inquiry is focused on three areas. The first area of investigation is the concept of property itself. Over centuries of evolution, the concept of property has acquired certain settled and traditional characteristics. Any new claims and accretions to the attributes of property should appropriately be measured against the traditional conception of property, not because tradition should be controlling, but rather because we need some objective measuring standard. The second subject on which history could shed light and useful insight is the classification of property. The question to be examined is how biotechnological discoveries and inventions would have been classified by ancient civilizations, such as Rome, that influenced the modern concepts of property. Finally, it would also be instructive to return to the policy justifications or philosophical rationale for the creation of property rights. The literature on the policy and philosophical justifications for property rights is both old and extensive. It might then be argued that there is nothing such an inquiry could uncover or add to the existing state of knowledge. However, the objective in this exercise is to draw attention to the fact that, even after centuries of debate, there continues to be disagreement over the general justifications for the existence of property. Perhaps even more important to us is what Becker has termed the question of specific justification; "namely, what sorts of people should own what sorts of

8. Moe M. Litman, *The Legal Status of Genetic Material,* in HUMAN DNA: LAW AND POLICY 19 (Bartha Maria Knoppers ed., 1997) (discussing the possible ways in which human DNA materials might be treated).

things and under what conditions."[9] Any guidance or illumination one can get on the issue of the assignment of property rights is particularly important when the rights involved concern life itself.

In summary, the goal of this article is therefore to confront the fundamental first principle issues relative to property rights in biotechnological inventions. We are aware of the differences in the biotechnology industry and that a single monolithic policy might not be appropriate for all situations. We are also conscious of the differential impact of different discoveries on society and the ecological balance. Such differences might justify a much more sensitive and discriminating policy approach. However, the goal of this article is to begin a generalized inquiry about the appropriate property regime for biotechnological inventions. Is there a general case for treating biotechnological inventions as *sui generis* deserving its own property regime, and, if so, what type? Given the results of the generalized inquiry it might be fruitful to consider the appropriate property treatment for specific categories of biotechnological inventions.

This article is divided into eight parts. Following the introduction in Part I, Part II is devoted to an overview of the biotechnology industry with the aim of creating the necessary background for the discussions that follow. In Part III, we address the historical and conceptual basis of property. First, we provide an analysis of the concept and attributes of property in order to determine the degree to which the concept of property is applicable to ideas in general and to biotechnological inventions in particular. Second, we address the classification of property under Roman law with the goal of determining whether certain things were excluded from the private property regime and why. The goal of such an inquiry is to determine whether, in general, biotechnological inventions fall into the category of things that should not be owned, since that might influence patent policy. Part IV addresses the policy justifications for the existence of property and the extent to which such justifications are applicable to biotechnological inventions. In that context, we first investigate the First Occupancy Doctrine of property. Next we examine the justification for property under Judeo-Christian doctrines. Then we explore the nature, operating premises, and scope of Locke's labor theory of property and see how it applies to biotechnology. Finally, we discuss traditional and economic utilitarian theories of property. In Part V we seek to develop a hierarchy of norms for patent policy and legislation. Parts VI and VII extend the policy discussion by providing additional policy considerations for developing a patent system. In this regard, Part VI focuses on the appropriate policy for the incentive to invent whereas Part VII addresses the adoption of the concept of the *usufruct* to ensure better and greater access to biotechnological inventions and ideas. Part VIII is devoted to some concluding remarks.

---

9. *See* LAWRENCE C. BECKER, PROPERTY RIGHTS PHILOSOPHICAL FOUNDATIONS 2-4 (1977) [hereinafter PROPERTY RIGHTS] (reviewing the theories of property and arguing for the need for a new theory).

II. BACKGROUND OF THE BIOTECHNOLOGY INDUSTRY

Almost half a century ago, in 1956, two brash and perhaps arrogant young scientists, Francis Crick and James Watson, announced in the Eagle pub in Cambridge, England, that they had discovered the secret of life in the form of deoxyribonucleic acid (DNA), the genetic material stored in the nucleus of every living cell.[10] That a bold declaration of a scientific discovery of such momentous import was made in a tavern was greeted with understandable skepticism by the scientific community. However, the claim proved to be more than an empty exercise of boastful youthful exuberance. For, after decades of scientific investigation and advances in DNA technology, the assertion by Crick and Watson that they had found the secret of life appears, in retrospect, to have been an understatement. Significant scientific advances in DNA technology have demonstrated that not only does DNA explain the very essence of every living cell but also that it holds a promise hitherto unfathomable.[11] The discovery of the nature, intimate structures, and functioning of all living organisms has ushered in a new era.

In this new era, knowledge itself is not as important as the possibilities it presents. Knowledge of the genetic structure of different life forms has now made it possible to push the limits of life sciences through tinkering or manipulation of intra-species or transgenic genetic structures.[12] With an understanding of the essence of life, it is now possible for the genetic structure of any living cell to be decoded with little effort. Using DNA technology, scientists can now identify with a high degree of particularity specific genetic traits and characteristics responsible for certain diseases, intelligence, athletic ability, or even leadership potential in human beings.[13] In the case of plants and other life forms, the DNA technology permits

---

10. *See* James Shreeve, *Secrets of the Gene*, 196 NAT'L GEOGRAPHIC 42, 49 (1999) (discussing the process of decoding DNA and the history of its discovery).

11. Prominent among the advances scientists have made is the mapping of the entire three billion letters of the book of life (human genome), which has been greeted with unusual superlatives. *See* David Pilling et al., *The Human Blueprint Unveiled*, FIN. TIMES, June 26, 2000 (noting that scientists and statesmen hailed the mapping of the entire human genome as a historic event comparable to the invention of the wheel); Clive Cooks, *Genetic Map Hailed as Scientific Revolution*, FIN. TIMES, June 26, 2000 (mentioning that knowledge of the three billion chemical letters of the book of life will transform health care and many aspects of life in the next century).

12. There are several reports of transgenic cloning whereby the genes of one species are inserted into another species to produce various proteins for medical uses. *See* Christopher Bowe, *Biotech Companies Plan to Milk Herds of Cloned Cows for Human Drug Needs*, FIN. TIMES, Oct. 13, 1999, at 6 (describing how advances in biotechnology have made it easier to clone large numbers of transgenic cows to produce certain pharmaceutical protein in their milk); Shreeve, *supra* note 10, at 44-45 (discussing cloned pigs used to produce a protein known as factor VIII, a clotting agent needed by type A hemophiliacs).

13. Discovery of what appear to be smart genes have raised questions about how that knowledge might be used by gene doctors. For a discussion of the discovery of the smart gene, see Michael D. Lemonick, *Smart Genes?*, TIME, Sept. 13, 1999, at 54 (describing the genetically engineered smart mouse at Princeton University and the potential benefits to human beings); Nancy Gibbs, *If We Have It, Do We Use It?*, TIME, Sept. 13, 1999, at 59 (raising questions and concerns about the use of smart genes for designer babies).

scientists to alter or confer specific traits and structures that affect the way these life forms function or respond to their environments.

Advances in DNA science suggest that DNA holds the potential for much good or much evil. For example, decoding the genetic traits of living organisms could lead to the elimination of certain diseases through genetic intervention at the cellular level or through the treatment of defective genes.[14] DNA science could also be used to identify and classify various genetic traits most susceptible to serious diseases, such as diabetes or cancer. Medical treatments and pharmaceutical products could then be designed for a target genetic pool.

However, the same scientific knowledge could be used to create the ultimate class structure by genetically controlling the characteristics of people, how long people live, where they live, and even what they eat.[15] It holds the risk of creating a world in which the human endowment at birth is not based on the probabilities of natural genetic selection but rather based upon preselection and genetic engineering. Inequality could then be the result of predetermined social engineering achieved through genetic manipulation.[16] As our knowledge of DNA technology deepens, the potential beneficent or maleficent use of such technology increases correspondingly. Whoever controls the sources of knowledge in DNA science will hold virtually immeasurable power.

Initially, the immense potential of the DNA discovery aroused the intellectual curiosity of universities, governments, research institutions, and scientists interested in the expansion of scientific knowledge and the propagation of ideas for the benefit of humanity. However, it soon became obvious to those engaged in research, venture capitalists, and to the business community in general that DNA technology held the promise of significant financial rewards, if the science could be converted into products or services. The realization of the potential for great financial rewards, in part, led to the emergence of the modern biotechnology industry of today. Universities and research scientists once committed to the credo of total openness were no longer merely interested in scientific discoveries in biology, biochemistry or the life sciences simply for the advancement of knowledge. They were now also interested in scientific discoveries that could be appropriated, protected within an intellectual property regime, and eventually transformed into products or services in the market place. Openness and sharing of knowledge and ideas which used to be

---

14. Curtis A. Kin, *Coming to the "Genetic Supermarket" Near You*, 48 STAN. L. REV. 1573, 1577 (1996) (explaining the nature and implications of gene therapy).

15. The ethical issues raised by biotechnology are serious and controversial. For a general discussion of the ethical issues raised by biotechnology see Daniel J. Kevles, *Social and Ethical Issues in the Human Genome Project*, 18 PHI KAPPA PHI J. 18-20 (1993) (discussing how: (1) eugenics might be used to determine which children live or are aborted; (2) genetic engineering might affect health care; (3) life and health insurance might be determined by genetic traits; (4) employment prospects such as in the United States Air Force might be controlled by genetics); UNESCO, *Report of Subcommittee on Bioethics and Population Genetics of the UNESCO International Bioethics Committee, Final Version*, Nov. 15, 1995 (discussing various interdisciplinary and ethical implications of biotechnology, including racism, population genetics, health, insurance and eugenics).

16. The problem of genetic discrimination has been alluded to by ethicists. *See* Kevles, *supra* note 15, at 21.

one of the distinctive and characteristic attributes of scientific investigation was replaced by acquisitiveness and exclusivity.[17] Thus, the focus of scientific investigation in DNA research shifted from pure science to applied science, with the market determining, to some extent, the direction of the effort. Biotechnology attracted the positive attention of financiers and venture capitalists looking for that single breakthrough invention or discovery that could instantly and forever transform their financial fortunes.[18]

The emergence and explosion in the biotechnology industry was fueled by two waves of significant investments. The first wave, which came in the 1980s, was a period characterized by investments of a speculative character. Investors were willing to commit large sums of capital based on the promise held out by the industry rather than on a rational analysis of a specific product-driven business plan.[19] However, after a decade of research and development, the potentialities of biotechnology became less speculative and a second wave of investments began in the 1990s. Although the typical capitalization of a biotechnology company is in the hundreds of millions of dollars,[20] using various investment strategies to minimize risk, venture capitalists, large global pharmaceutical companies, agricultural multinational enterprises and others interested in the biological or life sciences have been willing to organize and commit large sums of financial resources to particular companies, with high expectations of financially rewarding discoveries.[21]

Investor optimism is not misplaced. Reports of recent discoveries in various fields of biotechnology have heightened investor enthusiasm and touched off global competition among companies and between countries vying for dominance in the biotechnology industry.[22]

The success stories of the biotechnology research effort can be divided into two broad categories: healthcare and pharmaceutical products; and other agriculture and food products. In the case of healthcare and pharmaceutical products, biotechnology companies have evolved two interrelated strategies. The first and overarching strategy is to seize, alter, and control the gates to healthcare in the next millennium

---

17. KENNETH W. DAM, INTELLECTUAL PROPERTY AND THE ACADEMIC ENTERPRISE 1 (John M. Olin Law & Economics Working Paper No. 68 (2d Series) 1998).

18. The size of the investments in biotechnology only suggests the hopes entrepreneurs have in making significant returns on investments. *See* Lawrence M. Fisher, *The Race to Cash In On the Genetic Code*, N.Y. TIMES, Aug. 29, 1999, Business, at 1 (discussing the size of the market capitalization in the industry and the revenue generated).

19. *Id.* at 12.

20. *Id.*

21. Lawrence M. Fisher, *Strategies for the Genetically Disposed*, N.Y. TIMES, Aug. 29, 1999, at 6.

22. *See* David Pilling, *Drug Groups Wrestle with Seismic Shifts in Business Practices*, FIN. TIMES SURVEY, LIFE SCIENCES & PHARMACEUTICALS, Apr. 6, 2000, at 1 (discussing mergers of U.S. and international biotech firms in an effort to improve their position on the brink of new discoveries in the industry.); *see also* David Pilling, *Biotech Success a Geographical game of Chance*, FIN. TIMES SURVEY, LIFE SCIENCES, Oct. 28, 1999, at 1 (pointing out that there is an increase in interest in biotech industries in the U.S. as well as abroad, due to recent developments of new products and the prospects of new products in the not-so-distant future).

by controlling all the critical genetic pathways to disease and the remedial medical services and pharmaceutical products.[23] The current competition between biotechnology companies to map out the entire human genome sequence is, in large measure, motivated by the desire to acquire exclusive "gatekeeper rights." Such control over a potential market of over six billion people will permit the gatekeeper to exact whatever fees and terms it wants from those seeking admission. The gatekeeper strategy does not necessarily require the actual development of pharmaceutical products or services; that task can be assigned to others admitted into the realm of the gatekeeper.[24]

The second strategy involves the production of pharmaceutical or biomedical goods and services. The focus of this strategy is twofold: (1) to exploit scientific advances for the development of specific genetically engineered pharmaceutical products; and (2) to apply gene therapy to treat diseases traceable to certain gene deficiencies. Unlike genetically engineered pharmaceutical products that will be used to treat diseases, gene therapy will permit doctors to correct dysfunctional genes at the source by actually inserting and manipulating genes within a cell in order to prevent a genetic disorder.[25] Advances in DNA technology have made it possible for scientists to engage in transgenic cloning, whereby human genes are inserted within animals of other species such as cows, sheep, goats and pigs, to produce human proteins, antibodies, or tissue for the treatment of various diseases.[26]

Genetic engineering is not limited to biomedical and pharmaceutical activities. A similar process is underway in agriculture and agribusiness. After years of research and development, giant agricultural enterprises have now introduced genetically engineered, value-enhanced seeds, vegetables, fruits, and other plants.[27] Examples of genetically modified agricultural products include better tasting and longer lasting tomatoes, herbicide-ready seeds, Roundup Ready® soybean—engineered to contain a bacterial gene conferring tolerance to the herbicide glyphosate or Roundup®, insect resistant corn (Bt-corn), and many others.[28]

---

23. Fisher, *supra* note 18, at 1.

24. *Id.* at 12. Companies such as Incyte Pharmaceuticals Inc. are not interested in producing drugs but in supplying information and data to drug producers, at a price.

25. Kin, *supra* note 14, at 1577.

26. *See generally* Bowe, *supra* note 12.

27. The U.S. Department of Agriculture has issued a statement in which it explained the nature and benefits of value-enhanced crops produced through genetic engineering. *See Value Enhanced Crops: Biotechnology's Next Stage,* ECONOMIC RES. SERVICE/USDA AGRIC. OUTLOOK, Mar. 1999, at 18-19 (explaining the improvements in soybeans (high protein and amino acid soybeans), high lauric canola, high-oil corn, and others). For a discussion of some of the positive attributes of genetic engineering in crops, see *Frankenstein Plant?* 1 GLOBAL ISSUES AGRICULTURAL RESEARCH, Nov. 15, 1998 [hereinafter *Frankenstein Plant?*].

28. *See* THE ECON. AND POL. OF GENETICALLY MODIFIED ORGANISMS IN AGRIC. IMPLICATIONS FOR WTO 2000 (Bulletin 809, November 1999) at 1-8 [hereinafter *Genetically Modified Organisms*] (discussing the traits of genetically modified organisms including Bt Corn and glyphosate-resistant or Roundup Ready soybean); Michela Wrong, *GM May be a Matter of Seduction,* FIN. TIMES (Life Sciences) Oct. 28, 1999, at 4 (explaining the benefits of GM products such as Astra Zeneca tomatoes that have better flavor, longer life, etc.).

The controversy over what has been termed the "Terminator Seed"[29] seems to capture the strategy and direction of the research effort in bio-agriculture. The Terminator Seed originates from a patented technology that can engineer crops to kill their own seeds in the second generation. In other words, the Terminator Seed will produce sterile seeds and for that reason has been dubbed the "suicide seeds—genetically engineered seeds that beget sterile progeny."[30] The controversy and the implications of the Terminator Seed will be discussed later in section IV.D.2(ii).

For the moment, suffice it to note that the development of the Terminator Seed technology only reinforces the central strategic vision of biotechnology companies. It is not so much control over specific products or services that is sought, but rather ownership and control over the molecules or DNA sequences along the pathways to the products or the processes of genetic engineering.[31] Ultimately, controlling the pathways of genetic engineering would lead to an effective control over the end product itself. For instance, Astra Zeneca, a mere exclusive licensee of one of many genes used by outside scientists in the genetic engineering of a new type of rice that contains Vitamin A nutrients was able to control and dictate how the new invention might be used.[32]

The unprecedented advances made in biotechnology have touched off a storm of controversy and concern over the implications and impact of genetic engineering on society at large.[33] Critics are particularly concerned because genetic engineering appears to be moving into unchartered waters at an ever increasing pace. Prevailing scientific knowledge, which is still inadequate, suggests that the current natural

---

29. *See Frankenstein Plant?*, *supra* note 27 (explaining how the Terminator technology works); Hope Shand, *Terminator Seeds: Monsanto Moves to Tighten its Grip on Global Agriculture*, MULTINATIONAL MONITOR MAG., November, 1998 (discussing the potential impact of the Terminator Seed technology); Martha L. Crouch, *How the Terminator Terminates*, OCCASIONAL PAPER OF THE EDMONDS INSTITUTE, 1998 (offering a detailed scientific explanation of the Terminator Seed technology including the realities and misconceptions of the risks and dangers it may pose).

30. Shand, *supra* note 29.

31. Michael D. Davis, *The Patenting of Products of Nature*, 21 RUTGERS COMPUTER & TECH. L.J. 293, 308 (1995) (explaining the nature, goals, and strategies of biotechnology companies as centered on controlling channels and pathways of scientific innovation rather than products).

32. Madeleine Nash, *Grains of Hope*, TIME, July 31, 2000 at 39, 43 (Time magazine published a Cover Story on the importance of genetically modified foods in fighting world hunger and also addressed the problems faced by scientists motivated by humanitarian goals when their corporate sponsors have commercial interests).

33. Public outcry against genetically modified products is worldwide and the concerns are wide-ranging. *See Food for Thought*, THE ECONOMIST, June 19, 1999 (discussing the differences in European and U.S. public perceptions and protests against genetically modified products; offering different reasons for resistance to those products, such as this" they are unnatural, foods produced from them are dangerous, or they are bad for the environment). *See also Genetically Modified Organisms*, *supra* note 28 (discussing the economic and political implications of genetically modified organisms). The concerns over the impact of genetically modified organisms has led to a demand for Congressional action in the U.S.; *see* Adriel Bettelheim, *Reluctant Congress Drafted into Bioengineering Battle*, CONG. WKLY., Apr. 22, 2000, at 938 (discussing the policy choices faced by Congress in addressing the public reactions to genetically modified products, taking into account the interests of consumers and the biotechnology industry).

order of things took millions of years to evolve. Tinkering with nature at the molecular level makes some critics nervous.[34] It is feared that genetic engineering may contain hidden dangers to the current ecological, health, or bio-diversity balance and may expose humanity to risk of serious irreparable harm.[35]

While concerns over the impact on the environment, health, and bio-diversity are important, they are nevertheless speculative in nature and appear to be induced by fear.[36] However, concerns of perhaps equal importance and of a less speculative nature relate to questions of ownership and control over biotechnology discoveries, inventions and innovations.

---

34. Environmental organizations such Greenpeace have spearheaded the assault on the genetic engineering particularly as it relates to food. It is reported that Prince Charles made the following comment about genetic engineering that may be representative of the concerns of many: "I happen to believe that this kind of genetic modification takes mankind into realms that belong to God and God alone." *See* Michael Specter, *The Pharmageddon Riddle,* THE NEW YORKER, Apr. 10, 2000, at 58. According to Specter, unlike genetic engineering in medicine "playing with the molecular foundations of the food supply has seemed to many people like the agricultural equivalent of cloning a lamb—it crosses some unacceptable boundary." *Id.* at 61.

35. *See id.* (explaining the fears of opposition groups to genetic engineering). One of the main concerns is the impact of genetic engineering on the environment. *See* Carol Kaesuk Yoon, *Altered Corn May Imperil Butterfly, Researchers Say,* N.Y. TIMES, May 20, 1999, at A25 (explaining how genetically modified Bt corn pollen carries a toxin deadly to monarch butterflies); *Frankenstein's Plant?, supra* note 27, at 5-6 (discussing the environmental issues and concerns over super viruses, stubborn weeds and the impact on insects); *Food for Thought, supra* note 33 (discussing the grassroots nature of the coalitions formed against the genetically modified organisms); Michela Wrong, *Americans Get Wise to Agricultural Revolution,* FIN. TIMES, Dec. 16, 1999, at 11 (explaining that having lost its steam in the United Kingdom after government action, the debate and public outcry over genetically modified organisms gained momentum in the U.S. resulting in Food and Drug Administration hearings); Michiyo Nakamoto, *Japan's Food Labels Decision May Fuel Trade Friction,* FIN. TIMES, Sept. 16, 1999, at 8 (indicating that the concerns over genetically modified foods have reached Japan, resulting in the demand for the labeling of such products from foreign sources). The diversity in corn in Mexico is claimed to be threatened by the importation of genetically modified corn seeds which could contaminate native species. *See* Henry Tricks and Andrea Mandel-Campbell, *Mexico's Farming Habits Under Pressure From Transgenics,* FIN. TIMES, Oct. 12, 1999, at 8 (discussing the threat posed by the importation of transgenics to 24,000 varieties of corn in Mexico).

36. The fear and public hysteria that has been generated by opponents of genetic engineering is not always well-founded. Some scientists have felt obliged to step outside their laboratories to defend genetic engineering. *See,* Conrad Paul Lichtenstein, *This Other Eden,* FIN. TIMES, WEEKEND, Apr.1/Apr. 2, 2000, at 10, (arguing that there is nothing unnatural about genetic engineering or genetically modified organisms). "Indeed, those of us who still smoke inhale the combustion products of a natural GM event where foreign DNA entered tobacco millions of years ago somewhere in the Andes. Genes are handed on from parents to their offspring by 'vertical transmission.' As the hereditary genetic information replicates, natural errors—'mutations'—occur at random generating genetic variation." The cumulative effect of the natural selection process produces new species. *Id. See also* Lila Guterman, *Scientists Leave the Lab to Defend Bioengineered Food,* THE CHRON. OF HIGHER EDUC., Apr. 14, 2000, at A29 (describing the efforts of scientists trying to educate the population about the risks and benefits of genetic engineering based on the massive information available, rather than on fear). These scientists are also concerned about the impact of uninformed rejection of the biotechnology on the funding of research, not only in the United States, but also in the European Union. *See* Burton Bollag, *Public Pressure Puts a Damper on Biotechnology Research in Europe,* THE CHRON. OF HIGHER EDUC., Apr. 14, 2000, at A74 (discussing the decline in funding of genetically modified organisms in Europe). Some argue that genetically modified products are of high quality, but companies have not been able to market them properly and focus on their positive attributes. For an article addressing this point, see Ben Rogers, *Superior Tomato Puree is Not Enough,* FIN. TIMES, WEEKEND Oct. 2/Oct. 3, at III.

III. HISTORICAL AND CONCEPTUAL BASIS OF PROPERTY

A. *The Attributes of Property*

If, as discussed above, the mission of biotechnology is to unravel the mysteries of nature about life and living organisms, the question is raised whether such effort should be rewarded with the grant of property rights. The idea that biotechnological inventions and discoveries may be the exclusive and private domain of individuals presents several significant and fundamental policy concerns to be addressed. The concern is not just about the appropriateness of subjecting certain fundamental ideas about the cellular structure and functioning of all living organisms to the property regime. It is also about the impact of private ownership of discoveries and inventions which have the potential for a revolutionary and unpredictable transformation of human social and political organization. It is unclear whether such power should be left in the hands of private owners or should be made available to humanity at large. Moreover, what is sought to be owned generally involves ideas about the functioning of organisms at the cellular level or the processes and pathways in nature. Questions are further raised whether such ideas are part of the general human patrimony, not the appropriate subject of private ownership. These questions cannot properly be addressed without a return to the concept of property and its application to biotechnological inventions and discoveries.

Certain basic characteristics seem to lie at the core of western philosophical and jurisprudential notions of property. Property is often described in terms of dominion over a thing reinforced by the power of exclusion. This view of property is best exemplified in Blackstone's *Commentaries on the Laws of England*.[37] Blackstone presented a generalized power theory of property which was absolute, characteristically excessive, and logically driven. According to Blackstone, a property right is "that sole and despotic dominion which one man claims and exercises over the external things of the world in total exclusion of the right of any

---

37. *See* WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND (William Carey Jones, ed., Bancroft-Whitney Co. 1916) (1765). The argument might be made that any discussion of application of western property concepts to ideas must address the work of philosophers such as Kant and Hegel. However, because of space and time considerations the work of Kant and Hegel will not be discussed in this article. The interested reader might explore the following sources for the work of Kant and Hegel: GEORG WILHELM FRIEDRECK HEGEL, THE PHILOSOPHY OF RIGHT, (T.M. Knox Translation) (GREAT BOOKS OF THE WESTERN WORLD, Robert Maynard Hutchins Ed. 1952). The discussion of property starts at paragraph 41 and Hegel makes some comments about ideas or intellectual property in relation to physical property in paragraph 43. For a discussion of Hegel's concept of property as applied to intellectual property see, Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287, 330-39 (1988) (examining in detail the general tenets of Hegel's philosophy, his concept of property and its application to intellectual property). The protection of some forms of intellectual property rights such as copyright also caught the attention of Kant who argued for the protection of literary works. *See* IMMANUEL KANT, THE SCIENCE OF RIGHT (Translated by W. Hastie) GREAT BOOKS OF THE WESTERN WORLD, Robert Maynard Hutchins Ed. 1952). At page 425, Kant poses the question "*What is a Book?* and sought to explain why protection should be given to the publisher of books.

other individual in the universe."[38] A few comments are worth making about Blackstone's theory of property.

One has to be cautious about what implications to draw from Blackstone's views on this journey back into history. Because Blackstone sought to construct a system of property rights that was logically coherent, he felt compelled to fill any gaps with deductive reasoning and various legal fictions. Whatever lessons we might learn from Blackstone, we must remember Holmes' assertion that "the life of the law has not been logic: it has been experience."[39] One might say that, under the common law, *the case preceded the rule* as legal principles were created to solve specific problems as they emerged. Indeed, the evolution of the common law might more appropriately be likened to an elephant being constructed by four blind persons. The elephant is likely to take on lumpy and incongruent shapes at various stages of construction and, if the job is ever completed, it would probably lack symmetry. All of these counsel caution in seeking guidance from the common law past on this important question of property rights in biotechnological inventions.

Second, it should be noted that Blackstone's characterization of property limited property rights only to external things or physical objects (*res quae tangi possunt*),[40] also referred to by Grotius as "the irrational and inanimate part of the creation."[41] In attributing only physical characteristics to property, Blackstone was merely reiterating limited views held by ancient Roman jurists. However, the notion that property rights conferred on the owner absolute and despotic powers over the thing owned seemed excessive and extraordinary in the suggestion that no qualifications to property rights could exist either under Roman law or the common law. The power theory of property seemed to have been derived from the Roman law term dominion (*dominium*), often associated with the right to use, enjoy and misuse (*usus fructus abusus*) and, inferentially, power over the thing.[42] *Dominium* in its absolute

---

38. BLACKSTONE, *supra* note 37, Bk. II at *2.

39. *See* OLIVER WENDELL HOLMES JR., THE COMMON LAW 1 (1881). The quoted sentence was part of a series of lectures delivered by Holmes on the Common Law. The idea that the common law is based on experience, not logic, is fully captured in the following passage:

> The felt necessities of the time, the prevalent moral and political theories, institutions of public policy, avowed or unconscious, even the prejudices which judges share with their fellow-men, have had a good deal more to do than the syllogism in determining the rules by which men should be governed. The law embodies the story of a nation's development through many centuries, and it cannot be dealt with as if it contained only the axioms and corollaries of a book of mathematics. In order to know what it is, we must know what it has been, and what it tends to become.

Id.

40. The association of property with physical objects is old. It has been described as the physicalist conception of property which links property to things touchable. *See* Kenneth J. Vandevelde, *The New Property of the Nineteenth Century: The Development of the Modern Concept of Property*, 29 BUFF. L. REV. 325, 331 (1980) (discussing the physicalist conception of property and attributing this concept to Blackstone).

41. Hugo Grotius, *War and Peace*, READINGS IN JURISPRUDENCE AND LEGAL PHILOSOPHY 7 (MORRIS R. COHEN & FELIX S. COHEN 1951) [hereinafter READINGS IN JURISPRUDENCE].

42. MAX RADIN, HANDBOOK OF ROMAN LAW 335-337 (1927) [hereinafter ROMAN LAW] (discussing the nature and scope of the concept of *dominium* under Roman law).

form consisted of the following privileges and rights: *jus untendi*—the right to use a thing while keeping its corpus intact; *jus fruendi*—the right to use a thing by diminishing its outgrowth; and *jus abutendi*—the right to completely consume a thing and therefore end its effective existence.[43] It is doubtful whether one can infer from these rights absolute and despotic power over the thing owned.

Equally extraordinary was Blackstone's view that the right to exclude others was not only total, but also was held against the universe.[44] If by universe Blackstone meant the world at large, property rights would have no territorial limits, nor could they be modified or qualified for socially beneficial purposes. On the other hand, if the term universe merely referred to English property, then rights would have territorial limits, with their absolute character remaining intact.

An absolute view of property enjoys little or no support in history. Nonetheless, the power to exclude interference by others has been extensively relied on to define property. According to Justice Holmes, the power to exclude others gives property its legal character.[45] The power of exclusion was put in much more common language by Cohen when he asserted that property is that thing which has the label "Keep off unless you have my permission."[46]

Other conceptualizations of property relied less on power theories and more on analytical jurisprudence, expectations, and value. Thus, Bentham called property a legally protected expectation.[47] To others, property is anything that has an exchange value. Following the framework of analytical jurisprudence, Hohfeld described property rights as a bundle of many *paucital* (in personam) and *multital* (in rem) rights,[48] actual or potential, and falling within a spectrum of two polar extremes: dominion and exclusivity at one end, and the absence of dominion and exclusivity at the other.[49] Under this regime, property rights do not cease to exist merely because the owner does not possess absolute and despotic dominion over a thing because power and dominion are not essential attributes of all property rights. The bundle of property rights is divisible into different categories of control not limited to complete dominion and consistent with the type of property involved.

The Hohfeldian approach is much more sophisticated than the power theory of property and has been adopted by legal scholars and used to explain the modern liberal theory of property.[50] For instance, Honoré has argued that modern liberal property rights embody a bundle of at least eleven rights, prominent among which

---

43. *Id.* at 336.

44. BLACKSTONE, *supra* note 37, Book II at * 2.

45. International News Service v. Associated Press 248 U.S. 215, 246 (1918) (Holmes, J., dissenting) (describing the attributes of property as the "power of exclusion").

46. Felix S. Cohen, *Dialogue on Private Property*, 9 RUTGERS L. REV. 357, 374 (1954).

47. Bentham, *Theory of Legislation*, READINGS IN JURISPRUDENCE, *supra* note 41, at 8.

48. WESLEY NEWCOMB HOHFELD, FUNDAMENTAL LEGAL CONCEPTIONS 72 (Walter Wheeler Cook ed., 1919) (1913).

49. *Id.* at 94-101 (discussing the range and multiplicity of property rights).

50. PROPERTY RIGHTS, *supra* note 9, at 18.

are the right to possess, use, manage, and the right to the income and capital.[51] Becker describes the right to capital as perhaps the most important in defining ownership, because it includes "the power to alienate the thing, and to consume, waste, modify or destroy it."[52] A person may own all the rights in a property except the right to capital, but the one who holds the right to alienate, consume, or destroy is considered by Becker as the owner. The argument is not that property rights that fall short of the right of alienation cease to be such, but rather that a person may hold certain property rights in that which is owned by others. The significance of the Hohfedian approach is that property does not just denote dominion over a material object, but concerns a multiplicity of rights in relation to it with respect to others. These rights are capable of residing in different people at the same time. For instance, the right to alienate, or otherwise dispose of, property might reside in one person, while the right to use, whether exclusive or not, might be held by another.

The preceding brief discussion of the concept of property has significant implications for biotechnological products, inventions, and discoveries. However, a discussion of these implications requires an understanding of the basic characteristics of biotechnological materials. Biotechnological materials can be divided into three categories: (1) the physical output, including biotechnological products, goods, materials, and related services; (2) biotechnological materials which are sub-cellular and invisible to the naked eye, yet whose physical existence is not in doubt;[53] and (3) biotechnological inventions, discoveries, developments, and control of the pathways to the physical output or services.

To the extent that one of the characteristic attributes of property rights is dominion or power and control over tangible things (*res quae tangi possunt*), the *physical output* of biotechnological processes would fall within that definition of property. Accordingly, Dolly the sheep and various transgenic cows, pigs, and mice, and genetically engineered seeds and plants, could be owned. If we exclude them from the regime of private property, it cannot be because they cannot be controlled or be subject to the dominion of a person. The exclusion from the regime of property must be based on some other policy rationale or justification. However, the mere fact that cloned sheep or transgenic cows and pigs *can be privately owned* does not mean that *the process or the pathways* to cloning them, as well as other forms of genetic engineering, should *be privately owned.*

Sub-cellular materials not visible to the naked eye, micro-organisms, and enzymes have a physical presence and, for that reason, could be treated as private property similar to the products described above. Even though they share some characteristics with intangible assets, they are subject to certain types of control as tangible things. However, control over a thing is not determinative of property rights over it. A bailee, a robber, or a gunman may have control over a thing he does not

51. A. M. Honoré, Ownership, *in* OXFORD ESSAYS IN JURISPRUDENCE, 107-147 (A.G. Guest ed., 1972).

52. PROPERTY RIGHTS, *supra* note 9, at 7.

53. These materials may be classified under the physical category of things.

own. Ownership presupposes some legally recognized relationship of a person to a thing. But the determination of such legal relationship is a policy matter not necessarily dependent on control or the capacity to control a thing. A policy of conferring property rights on sub-cellular materials does not mean that the process of creating such materials should also be owned. That is to say, knowledge, information, and ideas concerning the process may be in the public domain as *res communes*, but the specific results of their use may be privately owned. The reasons for conferring property rights on the results of the use of *res communes* is not based on dominion or power, but on a policy rationale.

However, since such sub-cellular materials may involve life itself, including human genetic materials, it is not entirely clear whether all sub-cellular materials, micro-organisms and their enzymes and, in particular, those of human origin should be privately owned. Notwithstanding the fact that such materials can be controlled in the same manner as the seats in a Roman stadium, there might be policy justifications for excluding them from the regime of private property.

Biotechnological inventions, discoveries, and the process of genetic engineering raise different considerations. First, because they are intangible assets that involve information, data, knowledge, and ideas, they are not, by their nature, easily susceptible to control by inventors and researchers. It could be argued that because they are derived from knowledge, ideas, and information, they are not dissimilar to air, light, and other intangible things excluded from the private property regime under Roman law. However, the question of power or control over a thing is not necessarily determined by its physical attributes, but rather by the prevailing technological capability. Technological limitations of today may make certain things uncontrollable, but future advances in technology may change that situation. Advances in technology may bring more things within human control and dominion than was previously possible. For instance, due to advances in satellite technology, telecommunications, star wars hardware, and sophisticated computer hardware and software, it is now easier to control access to and the use of large portions of the high seas than was possible during the Roman era, or even a century ago.[54] Thus, the inability to control intangible assets because of their incorporeal nature cannot be determinative of the issue of ownership. Whether private property rights should be created for biotechnological inventions is therefore a significant public policy issue to be resolved in the future.

Moreover, control over a thing can be achieved through means other than physical force or restraint. A regime of secrecy backed by an enforcement mechanism can be effectively utilized to maintain control over biotechnological inventions, ideas or information. A regime of secrecy supported by the law of contract allows inventors and researchers to extract a binding agreement to maintain

---

54. Current military hardware and the attempt to development a missile defense system are examples of the nature of control that can be exercised over any part of the globe from the air. *See* Todd Halverson, *Ability to Detect Missiles Tested*, GANNET NEWS SERVICE, May 23, 1993.

secrecy from those having access to research results or inventions. The current legal regime for the protection of trade secrets is substantially contract based.[55] The issue is therefore not whether biotechnological discoveries or inventions *can* be controlled under a regime of secrecy, but rather whether they *should* be the subject of private ownership. If they *cannot* be privately owned, then it is further doubtful whether they can be excluded from the public domain through private secrecy agreements. In other words, that which is in the public domain cannot be the subject of an enforceable secrecy agreement. Thus, private parties cannot by agreement between them confer rights in contravention of a deliberate policy of exclusion of a thing from private ownership. Such a position might be justifiable particularly when we are dealing with inventions, ideas and information of critical importance to existence itself. The reason for excluding biotechnological discoveries and inventions from the protective umbrella of the property regime would then be policy-based rather than based upon the lack of capacity to control.

The significant social, economic, and political implications of the advances made in biotechnology compel a more careful inquiry into whether they should be privately owned, and, if so, by whom and for how long. Biotechnological inventions, similar to such things as air, light, the beach, and seats in a Roman stadium, have the characteristics of a public good. Inventions originate from ideas, basic knowledge, and general information which have a public good character. These inventions also maintain their public good character, in that they cannot be depleted by multiple use by people other than the inventor.[56] The issue of whether they should be excluded from general access and use cannot be based on concerns that the inventor will be deprived of his asset through depletion from multiple use. Rather, the real concern is how the cost of the invention should be handled and how inventive activities can be encouraged. How these concerns are addressed is a question of policy rather than the attributes of intangible assets.

Biotechnological advances, whether they come in the form of inventions or discoveries, require the investment of significant amounts of financial and other resources.[57] The question is whether the cost of these inventions justifies granting property rights to the inventors in order to encourage inventive activities. The

---

55. The earliest reported trade secrets case in the united Kingdom in which judicial protection of trade secrets was sought is said to be *Newbury v. Jones*, 2 mer. 445, 35 Eng. Rep. 1011 (1817) (request for injunctive relief based on a trade secret agreement denied). *See also* Smith v. Dickenson, 3 Bos & Pul. 630, 127 Eng. Rep. 339 (1804) (successful action for breach of secrecy agreement). For the United States, the first reported case is said to be *Peabody v. Norfolk*, 98 Mass., 452 (1869) (recognizing property rights in trade secrets). In a more recent decision of the U.S. Court, the protection of trade secrets is based on the common law of the states. *See* Kewanee Oil Co. v. ICRON Corp., 416 U.S. 470, 481-486 (1973) (discussing the definition and policy rationale behind trade secret protection).

56. *See* KENNETH S. ARROW, ESSAYS IN THE THEORY OF RISK BEARING 151 (1971) (discussing the indivisibility nature of information). *See also* MARK CASSON, ALTERNATIVES TO THE MULTINATIONAL ENTERPRISE 36-38 (1979) (discussing the diffusability of information); Kojo Yelpaala, *In Search of Effective Policies for Foreign Direct Investment: Alternatives to Tax Incentives Policies*, 7 NW. J. INT'L L. & BUS. 208, 220 (1986).

57. Fisher, *supra* note 18.

incentive to invent argument is a complex one not easily susceptible to falsification through theories of causation. This argument is examined below under the policy justification for creating property rights in biotechnology.

On the other hand, the consequences of granting private ownership rights might be so undesirable that an alternative technique of handling the cost should be explored. For example, public funding of biotechnology research and inventions is the most appropriate policy choice if the public good and *res communes* character of such inventions should be maintained.[58] However, public funding is only one of several policy choices.

Finally, one of the most important questions to be resolved is the scope of property rights that might be granted. Relying on the Roman law term *jus utendi fruendi abutendi*, modern property theories, following Blackstone's characterization, seem to suggest that the holder of a property right holds the absolute right to use, enjoy, misuse, or destroy his property.[59] However, *usus, fructus* and *abusus* did not connote the absoluteness of rights thereafter asserted by subsequent jurists such as Blackstone. The Roman law origins of the claim of absolute and despotic rights are questionable. According to Richard Theodore Ely, the contention that property rights included the absolute right to destroy or misuse property was due to bad translation of the word *abutendi* in the Roman law phrase "*dominium est jus utendi et abutendi re.*"[60] As explained in the section on Roman classifications, the word *abutendi* connoted using a thing until it was depleted and consequently ceased to exist. This meaning of *abutendi* does not easily fit the concept of destroying one's property, which implies wantonly to lay waste to the thing owned. As further explained by Ely, the property rights embodied in that phrase were further qualified by the clause "*quatenus juris ratio patitur*" in so far as the reason of law permits.[61] However, the holder of a property right might misuse it as in *abusus* but such use might only relate to power or capacity, which does not require any legal sanction. Besides, the term *abusus* (misuse) is both a normative and an ideological concept, because it connotes putting something to a use unapproved by societal norms; it is the negative side of the term *usus* (use). Whether a particular use of property is a positive or negative use or whether it benefits or harms society depends on some normative standard which may say nothing about the necessity or beneficial nature of the particular use.

It is, however, possible that the old Roman concept of *jus quiritium* or quitarian ownership might have given rise to the notion that property rights were absolute.[62]

---

58. Rebecca S. Eisenberg, *Public Research and Private Development: Patents and Technology Transfer in Government-Sponsored Research*, 82 VA. L. REV. 1663 (1996) (discussing the history of policies behind government sponsored research and the different ways in which access to the results might be created).

59. PROPERTY RIGHTS, *supra* note 9, at 19.

60. Richard Theodore Ely, *Property and Contract in their Relation to the Distribution of Wealth*, in READINGS IN JURISPRUDENCE, *supra* note 41, at 12.

61. *Id.*

62. ROMAN LAW, *supra* note 42, at 336.

Jus quiritium consisted of peculiar property rights strictly preserved for Roman citizens who could exercise certain rights with respect to *res mancipi* without legal let or hindrance.[63] Rights in *res mancipi*, which included lands located in Italy, slaves, cattle, horses, mules and asses, could only be created after an elaborate ceremony transferring legal title or ownership.[64] While quitarian ownership conferred certain powers upon Roman citizens, it seems inaccurate to equate those rights with absolute and despotic power. Roman citizens holding quitarian rights were limited by law as to whom those rights could be sold. For example, aliens were prohibited from purchasing or otherwise acquiring those rights.[65] Such limitations, even if they were directed at aliens, nevertheless operated as restrictions on Roman citizens and would tend to undermine the notion of absolute or despotic rights. Moreover, dominion under Roman law did not denote absolute or despotic power over a thing even if it had significant economic implications to the owner. The owners of slaves under Roman law could not maltreat or kill them.[66] The rights of slave owners did not rise to the level of complete dominion, which included destruction through killing. Similar limitations and constraints were imposed on landowners. The rights of land owners were significantly qualified by the existence of neighboring land holdings, particularly public highways.[67]

B. Roman Law Classification of Property

While the concept of property offers some guidance on how biotechnological inventions and discoveries might be treated under the property regime, further guidance may be obtained from the examining the classification of property. In a sense, the concept of property implicates the issue of classification of things as proprietary and non-proprietary. What distinguishes property from non-property is not just a question of definition but also a question of classificatory policy. Biotechnological inventions and discoveries can be classified a property or non-property based on policy choices. Where the line should be drawn is not a simple one and a journey back into history might provide some assistance on the choices to be made. The most appropriate historical excursion is into Roman law because the origins of western property concepts are traceable to Roman law.[68]

---

63. *Id.*

64. WILLIAM L. BURDICK, THE PRINCIPLES OF ROMAN LAW 312-13 (Wm. W. Grant & Sons, Inc. 2d ed. 1989) [hereinafter PRINCIPLES OF ROMAN LAW] (describing the nature of *res mancipi* and *res nec mancipi*).

65. *Id.* at 314.

66. ROMAN LAW, *supra* note 42, at 337.

67. *Id.*

68. The influence of Roman law on many modern western legal systems cannot be doubted. That influence is best captured in the first paragraph of Burdick's book, PRINCIPLES OF ROMAN LAW, where he stated:

> The Roman Empire as a political organization passed away centuries ago, but Roman jurisprudence through its influence still remains a world power. In its modernized form Roman law has become the law of more than three-fourths of the civilized globe, and Gibbons words written in the eighteenth century "the laws of Justinian still command the respect or obedience of the independent nations," are

Early Roman jurists were practical men who did not delve into the philosophical foundations or justifications of property.[69] This does not mean that policy justifications for the existence of property rights did not exist. Such policy rationales might have existed but remained unarticulated. While later jurists and codifiers rooted the existence of property in natural law, or *jus gentuim*, earlier jurists were first interested in the classification of things (*res*).[70] The classification of property proceeded from the general to the specific. At the top were two general categories: things that could be the subject of private ownership or dominion (*res in nostro patrimonio*); and those that could not be the subject of private ownership (*res extra nostrum patrimonium*). The things that were excluded from private property were further divided into four categories.

First were *res communes* or common property which belonged to all human beings in common. *Res communes* included air, running water, the sea and the shore of the sea.[71] *Res communes* was, however, distinguishable from the second category, *res publica,* or public property that did not belong to humanity at large, but rather belonged only to all people within the state or the general public. *Res publica* included harbors, rivers, and public roads in which the public had only the right of use and enjoyment.[72] The third category of property, called *res universitatis*, or property of a corporate entity, had a narrower group of ownership. It belonged to all members constituting the corporation as a group, but not in their individual capacity.[73] Included in this category was property of municipalities such as *theaters* and *studia*.[74] The right to use and enjoy such property was however held by the members. Thus, citizens of Rome were entitled to enter and use vacant seats in the amphitheater which could not be privately owned. The last category of things not subject to private ownership was *res divini juris*, or property governed by divine law.[75] This category of things included the following: sacred property (*res sacrae*), religious property (*res religiosae*), and holy things (*res sanctae*).

Finally, it should be noted that not all things that could be the subject of private ownership were actually owned. *Res nullius*, referred to things belonging to no owner. *Res nullius* was further divided into two sub-categories: things not susceptible to private ownership, such as things governed by divine law, and those,

---

even more significant today than then.

PRINCIPLES OF ROMAN LAW, *supra* note 64, at 1. The influence of Roman law concept of property on modern law can be seen in the classification of property. *Id.* at 298-323.

69. *See generally id.* at Chap. IV., ROMAN LAW, *supra* note 42, at Chap. 2.

70. *See* ALAN WATSON, THE LAW OF THE ANCIENT ROMANS 49 (1970) (discussing the emphasis of ancient Roman jurists on the classification of things).

71. *See* PRINCIPLES OF ROMAN LAW, *supra* note 64, at 307; PH. J. THOMAS, INTRODUCTION TO ROMAN LAW 34 (1986) [hereinafter INTRODUCTION TO ROMAN LAW]; 2 JUSTINIAN, THE CIVILIAN LAW 33 (S.P. Scott, 1973 ed.).

72. *See* PRINCIPLES OF ROMAN LAW, *supra* note 64, at 307; INTRODUCTION TO ROMAN LAW, *supra* note 71, at 34.

73. PRINCIPLES OF ROMAN LAW, *supra* note 64, at 308.

74. *Id.*

75. *Id.* at 310.

while susceptible to private ownership, were not presently owned.[76] This last category would include *ferae naturae*, or wild animals, birds, fish and unappropriated pebbles or gems on the beach.[77]

What was it about *res extra nostrum patrimonium* that excluded them from being the subject of private ownership? They did not all share the same physical characteristics, nor serve the same social purposes. Some of them were tangible and visible; others, such as air, were intangible and invisible. While some classical scholars and the codifiers explained the classification in terms of natural law,[78] that justification does not fully explain why certain things could not be privately owned. Natural law was such a variable and contradictory concept throughout the history of Roman law[79] that it could not offer a singular policy rationale behind the classification. Moreover, as noted above, Roman jurists were practical men who were concerned not so much with the essence of things as with their practical utility. One must then seek additional policy justifications from other sources.

The starting point for an alternative policy justification might be an examination of the basic characteristics of things excluded from the subject of private ownership. A careful review of the list will show the following. First, some of the things were central to life and living. Running water, rivers and the air were critical to living beings and must not then be appropriated by an individual, the state or any other corporate entity even if they could. It is unclear whether, under Roman law, the state could lawfully create private property rights in those things falling into the category of things that must not be owned such as *res communes*.[80] If the exclusion of certain things from the property regime was dictated by natural law, however defined, the

---

76. *Id.* at 341. *Res nullius* include the following: (1) animals *ferae naturae*, (2) new things that come into existence by natural causes, (3) property of an enemy (*hostis*), (4) things abandoned by their owners (*res derelictae*), and (5) treasure trove (*thesaurus*) i.e. things hidden or concealed in the earth.

77. *Id.* at 308.

78. BRIAN TIERNEY, THE IDEAS OF NATURAL RIGHTS 136 (1997) (discussing the use of natural law by Roman jurists such as Gaius).

79. *Id.* at 137-48 (examining the different uses of the concept of natural law by different jurists at different times).

80. The location and exercise of legislative powers in Rome differed depending the time of history involved: early days of Rome, the Republic era, and the era of emperors. Irrespective of the era, the nature of legislative powers is unclear. There is little evidence of whether the legislature could exercise any or all powers in legislating on various subjects. Even during the post republican era when the legislative powers were in the hands of the emperor, it is unclear whether that power was not limited in law or in fact by civil or natural law. *See* WILLIAM A. HUNTER, A SYSTEMATIC AND HISTORICAL EXPOSITION OF ROMAN LAW XLVIII (Wm. W. Grant & Sons, Inc. 2d ed. 1994) (pointing out that the legislative powers of the emperor were defined by specific statutes thereby raising the question of whether such powers might have been limited). For further discussion of the legislative process in Rome see E. P. BURKE, HISTORICAL ESSAY ON THE LAWS AND THE GOVERNMENT OF ROME 230-37 (Wm. W. Grant & Sons, Inc. 1994) (1827) (explaining that in the post Republican era there was absolute monarchy in which the prerogative of legislative powers was solely vested and as legislator the emperor had no opposition, no fear, no dilatory forms of proceedings that could slow down the process and execution of laws). It is still not clear what this meant if the legislative powers of the emperor were based on specific statutes. *See generally* ALAN WATSON, THE LAW OF THE ANCIENT ROMANS 10-16 (1970) (discussing the legislation, the law of the Kings and the Twelve Tables).

state might have lacked the power to interfere with the dictates of such law. While it might be argued that the list of things excluded from private ownership were mostly things that could not easily be controlled, it was not so much the impossibility of controlling them as it was their importance to human existence that accounted for the result. For example, running water and the seashore could be controlled, but were nevertheless excluded from private ownership. The reason must have been because of some other policy justification and not because they could not be controlled.

The seas and rivers were important to the Romans and humanity for navigation, transportation and commerce. It is conceivable that the protection of such societal interests led to a policy of recognizing ownership of the land around a river but not the river itself or the running water. Private ownership of the shores would impede the ingress and egress of ships, which would not be beneficial to a sea-faring nation.

Some of the things excluded from private ownership had the character of a "*public good*"[81] in that they could be used over and over again by different people without being easily depleted.[82] The beach, harbors, public roads and seats in a stadium fall into this category. While beaches and shores were naturally occurring, harbors, public roads, and *stadia* had to be built and maintained at some considerable expense. Such costs nevertheless did not deprive them of their beneficial character. Navigation, transportation, and entertainment were so important to the Romans that they appeared unwilling to privatize access to them.

Some other things, like the air and the sea, could not easily be controlled. However, it is doubtful whether their indomitable character explained their exclusion from private ownership. Rather, it appeared that their importance in nature and to existence, was the reason for their exclusion from private property.

Some things of a spiritual character were also excluded from private ownership. This category included things that generally could be privately owned yet because of the use to which they could be dedicated, a policy was adopted to exclude them from the category of appropriable things.

What lessons might one learn from the ancient classification system? How would biotechnological inventions and discoveries fit into the system? It should be noted that the classification system included a category for corporeal things and incorporeal things. Incorporeal things were abstract conceptions which were protected by law but could not be the subject of ownership.[83] Thus, a distinction was made between legal protection in general and legal protection through ownership. It is important to note that biotechnological inventions and discoveries would largely

---

81. *See* ARROW, *supra* note 56, at 151 (discussing the indivisibility nature of information); *see also* CASSON, *supra* note 56 at 36-38 (1979) (discussing the diffusability of information); Yelpaala, *supra* note 56 at 208, 220 (1986).

82. *See* ARROW, *supra* note 56; CASSON, *supra* note 56; Yelpaala, *supra* note 56.

83. INTRODUCTION TO ROMAN LAW, *supra* note 71; JUSTINIAN, *supra* note 71, at 43; PRINCIPLES OF ROMAN LAW, *supra* note 64, at 303, 312-13.

fall into the category of incorporeal things and, *ab initio*, should be incapable of private ownership under this reasoning.

However, our inquiry about the policy considerations in biotechnological innovations might benefit from the discussion of the classification of things in general. Because biotechnological inventions concern life itself, they have significant implications similar to those surrounding air, running water, rivers and other things excluded from the possibility of private ownership under Roman law. Thus, quite apart from the incorporeal argument for exclusion, it might be useful, in the modern context, to examine whether there are sound arguments for excluding biotechnological inventions, discoveries and innovations from the regime of private ownership. If we follow the Roman classification model, can we conclude that some biotechnological inventions and discoveries are in the public domain and must not be interfered with through legislation? Moreover, biotechnological inventions and discoveries share the characteristics of a public good. As discussed above, inventions, ideas and concepts are diffusible and inexhaustible with multiple and simultaneous uses. The classical jurist saw no policy justification for denying access to things with a public good character. The reason for allowing access seemed magnified when the public good had significant implications for life and living, as do biotechnology discoveries. But policy considerations based on the public good characteristics must take into account the cost of inventions. Because biotechnology research involves billions of dollars, the funding of such activities might have to be reconsidered if the results of the research and development are to be treated as a public good.

Finally, one of the relevant policy issues raised by classification system is the question of control. It appeared that some of the things not susceptible to private ownership were also not easily susceptible to human control. In the same vane, biotechnological inventions originate from and form part of knowledge, ideas, and concepts not easily controlled once disclosed. However, it has been argued that the inability to control is not in and of itself the reason for exclusion from ownership. Knowledge, ideas, and concepts are essential for human civilization and for that reason have always belonged to the category of things that "*cannot*" and "*should not*" be controlled through private ownership even if the control became technologically feasible.[84] Such a position is not controlled by the nature or the essence of the thing, but rather by some fundamental policy justification.

It would therefore appear that a study of the ancient classification of things under Roman law could be beneficial to modern policy issues concerning the treatment of biotechnological inventions and discoveries. The specifics of how the classificatory system might influence the treatment of complex modern scientific advances would be based on the study of the basic issues of life, its sustenance, the

84. It is undisputable that the concept of property rights in ideas is of very recent origins. *See supra* note 4 and accompanying text.

propagation of knowledge, the advancement of humanity and other competing issues.

C. Summary

It is apparent from this brief historical survey of the nature of property that any debate over how to treat biotechnological inventions and discoveries might benefit from the lessons of history. History has taught us that the classification and assignment of property rights was often guided either explicitly or implicitly by some larger social objective. Certain things and objects considered important or central to life or to the fundamental tenets of society were excluded from the regime of private property. In part, the goal was to make such things available to all citizens and in some cases to humanity at large. Equally important is the lesson that property consists of a bundle of rights capable of being held and exercised by different people at the same time. The Hohfeldian bundle of rights theory minimizes the importance often assigned to the right of exclusion as a defining element of property. Finally, history has also taught us that property rights are often the subject of limitations and restrictions imposed to achieve certain societal objectives. Power theories of property that grant property holders absolute and despotic rights cannot easily and legitimately be supported by the history of Roman law.

All of these lessons are particularly important to our discussion concerning the treatment of biotechnological inventions. The question is whether any attempts to design a regime for property rights in biotechnological inventions should not draw on some of the important lessons of history. For instance, should biotechnological inventions be excluded from the regime of private property or at least be subject to restrictions. Certain specific limitations and constraints may become particularly important given the significant socio-economic, ethical, environmental, cultural, political and a whole host of other implications of biotechnology.

It is apparent from the preceding sections that any discussion of the nature and classification of property inevitably raises fundamental policy choices. A classificatory system for property that distinguishes between things that can be owned and those that cannot, or between different categories of property, presupposes some explicit or implicit policy choices. That the distinction between property and non-property is one based on policy is much more apparent when the classificatory system treats two things that share the same physical characteristics or distinctive attributes differently under the same property regime. One may be included and the other excluded from things that can be owned. Moreover, Roman law traditions only manifested the contradictions and ambiguities inherent in legal systems. For it was the same legal system that excluded certain things from the regime of private property because of their importance to humanity and life itself, but recognized property rights in human beings even as it insisted all people are born free. What inferences can be drawn from these contradictions and ambiguities? Would the Roman jurists have recognized property rights of slave masters in the

essential and constituent biological elements of slaves if they were confronted with the continuing advances made in biotechnological inventions of this era? Because of the inherent contradictions in the ordering of human social organizations, the answers to these questions are not obvious. It would therefore appear that the central issues concerning how biotechnological inventions and discoveries might be treated are more a question of fundamental policy than the essence of things.

IV. POLICY JUSTIFICATIONS FOR PROPERTY RIGHTS

A. The First Occupancy Doctrine

One of the earliest justifications for private property was advanced by Roman jurists who asserted that the first occupation or acquisition of *res nullius* (things that belong to no one) conferred property rights on a person.[85] If a thing belonged to no one there could be no objections to its acquisition by someone. But first acquisition *per se* was not sufficient to confer property rights. As a precondition, the thing acquired must have belonged to the category of things that could be owned and would not have been already owned. These two conditions would ordinarily be satisfied with the concept of *res nullius*. But why would the first acquisition of *res nullius* justify conferring property rights on the acquirer? Did the justification arise from the nature of the acquiring act, the nature of the thing acquired, or some other policy justification? To Roman jurists the answer lay not so much in the act or object of the acquisition as it did in natural reason taught to humanity by *jus gentium*.[86] Gaius, for example, maintained that it was only natural and rational that "what belongs to no one is conceded to the occupier."[87] By relying on *jus gentium*, the Roman jurists saw the first occupancy doctrine as a universal justification for the existence of property since *jus gentium* was applicable to humanity at large. Apparently, the Romans could not conceive of a society of rational human beings who, on the basis of natural reason, would reject the first occupancy justification for property.

While the universality of the first occupancy doctrine may be debatable, it is doubtful whether within its own terms it could be used as a justification for granting property rights in biotechnology inventions and discoveries. Such an attempt would immediately be met with certain difficulties. At the outset, it must be determined whether biotechnological inventions satisfy the first condition for private property—whether they fall into the categories of things that can be owned. We have already argued above that biotechnological inventions and discoveries—like ideas, know-how, processes, knowledge, additions to knowledge including inventions—did not

---

85. TIERNEY, *supra* note 78, at 136, PRINCIPLES OF ROMAN LAW, *supra* note 64, at 333-34; ROMAN LAW, *supra* note 42, at 341.

86. PRINCIPLES OF ROMAN LAW, *supra* note 64, at 333.

87. TIERNEY, *supra* note 78, at 136.

fall into the categories of things that could be the subject of private property. Ancient societies appear to have placed significant value on the propagation of knowledge and ideas because they are essential to the formation of coherent human social, economic, and political organization. They chose to leave ideas, techniques, methods, know-how and basic knowledge unprotected as property no matter how important they might have been. Thus, they did not create private property rights even in historically significant inventions such as the wheel or gun powder.

History has taught us that ancient civilizations—such as the Egyptians, the Greeks, the Romans, the Persians, and the Chinese—borrowed ideas, processes, and know-how from one another and passed them on to other societies and eventually into modern societies.[88] For the Roman jurists, the issue would not have been whether or not biotechnology inventions are valuable, but whether creating property rights in them would have undermined the basis of societal progress, i.e., the development of the arts, civil engineering, manufacturing techniques, ship building, and the general economic well being of society. It bears stressing that the importance of biotechnological inventions lie not so much in the products derived from them as it does in the pathways to those products.[89] The Romans would probably have opted to leave such pathways open and uncluttered with private property rights in order to provide benefit and use to humanity. The arguments advanced so far would also be applicable to biotechnological inventions that have a physical or tangible character. Such inventions also derive their importance from their pathways and because they concern life itself, raise serious questions about whether such materials should be owned on the basis of first acquisition through discovery or invention.

B. Judeo-Christian Property Concepts

The problems confronted by the Roman law concept of first occupancy principle seem to pale in comparison to those created by a reformulation of the first occupancy doctrine advanced by subsequent philosophers and jurists of the Judeo-Christian tradition. With the arrival of Christianity and the infiltration of Christian theology into the intellectual discourse of the medieval era, the approach to the origins of property experienced a decided and significant shift from the somewhat secular Roman approach.[90]

The influence of Christian theology on the concept of property came as a result of certain developments in Europe during and after the medieval era. Medieval

88. For a very general discussion of this point, see THUROW, *supra* note 1, at 101-02.

89. Davis, *supra* note 31.

90. The supernatural has always played some role in society in the conception and formulation of property. When the role of the supernatural comes in written document laden and laced with coded text discovering the role of the supernatural is a difficult task of interpretation. Such was the case of the role of the Holy Bible in the evolution of the concept of property in medieval Europe. For a discussion of the difficult task of explaining the nature and origins of property within the context of the Christianity, see TIERNEY, *supra* note 78, ch. 6.

Europe is often described as steeped in darkness and unenlightenment. Yet, even during the dark days of medievalism, certain pockets of enlightenment thrived and acted as a spark plug for subsequent revisionist theories of property to emerge. Medieval schoolmen, scholars, and teachers in the universities devoted their entire lives to the study, analysis and debate over the fine points of Roman law.[91] Pawing through ancient texts and commentaries with the keen eyes of an eagle, these scholars kept the otherwise dead subject of Roman law alive, refined, and accessible as a well of knowledge. From this well, the Church, secular princes and various factions with conflicting interests could draw on the concept of property to serve their needs.[92] Thus, when the great Franciscan debate erupted in the Thirteenth Century, the disputants drew on the Roman law of property that had evolved to that point.[93]

The central issue in the Franciscan debate was consistency of the acquisition and ownership of property with Christianity.[94] With a denunciation of acquisitiveness or property and the embracing of poverty, the Franciscans believed that they had seized the higher moral ground of true Christian morality. They argued that property and its central significations of complete dominion, exclusivity, and the concomitant right to deny access were inconsistent with the teachings of the Holy Scriptures.[95] It took the intervention of the Vicar of Rome to resolve the debate. In answer to the Franciscans and their sympathizers, Pope John XII traced the concept of property to Divine law, arguing that the Grant by God to humanity included the permission to appropriate from the commons as private property.[96] By elevating property to the status of Divine law, the logical inconsistency between private property and Christian morality was removed. What was sanctioned by God could not clash with Christian morality.

While the intense theological and intellectual debates of the time produced various justifications for property (divine law, *res nullius*, natural law, human law),[97] the supernatural emerged as a dominant theme in the debate over property. Indeed, it can be said that the single most important event that influenced the shift from the

---

91. Bouckaert, *supra* note 2, at 785 (discussing the role of medieval universities in maintaining the study of Roman law which was in practice dead).

92. *Id.* at 785-86.

93. *Id.* at 786.

94. *Id.*; *see also* TIERNEY, *supra* note 78 (discussing the theological disputations on the question of property and in particular the Franciscan debate).

95. The Franciscans were faced with a peculiar dilemma. Even as they denounced property they had accumulated significant amounts of wealth from providing various services. They were in a better position to appreciate the potential impact of the right to exclude others from using property even when the owner had more than was necessary for his survival. They had more than they needed. Bouckaert, *supra* note 2, at 786.

96. *Id.* at 787; *see also* TIERNEY, *supra* note 78, at 154-56 (quoting Pope John XXII answering his critics on the question of the creation of private property from common property saying, "Dominion of temporal things was not introduced by primeval natural law understood as the law common to all animals . . . nor by the law of nations, nor by the law of kings or emperors, but by God who was and is the Lord of those things.").

97. *See* TIERNEY, *supra* note 78, at 144 (discussing a scattered collection of scholarship on the subject of the Decretum).

secular reasoning of the Romans to some supernatural or divine intervention was the arrival of Christianity with the Holy Bible in hand. Christian doctrine assigned a central and controlling role in the explanation of property to the Holy Bible.[98] But the imprint of Christian thinking on the origins of property had to wait until the Seventeenth Century to be fully assembled, developed and advanced by a learned Dutch jurist, Hugo Grotius.[99] Drawing heavily from the Holy Bible, Grotius, in his famous masterwork, *De Jure Belli et Pacis* (On the Law of War and Peace), asserted that private property was but a subset of a larger sample of all things and creatures God gave to mankind to hold in common and as inheritors of one general patrimony.[100] Other philosophers and jurists of that era also found justification for property in the Holy Bible. For instance, relying on the Holy Bible as a historical document, Blackstone made the following observations about the first property rights:

> In the beginning of the world, we are informed by holy writ, the all-bountiful Creator gave to man "dominion over all the earth; and over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." This is the only true and solid foundation of man's dominion over external things, whatever airy metaphysical notions may have been started by fanciful writers upon this subject. The earth, therefore, and all things therein, are the general property of all mankind, exclusive of other beings, from the immediate gift of the Creator. And, while the earth continued bare of inhabitants, it is reasonable to suppose, that all was in common among them, and that everyone took from the public stock to his own use such things as his immediate necessities required.[101]

This account of the grant to humanity was common among historians and philosophers in the post medieval era. John Locke in his Two Treatises of Government asserted that God gave the world to Adam and his posterity in common.[102] Quoting the Psalms of King David, Locke stated that "'tis very clear, that God . . . has given the earth to the children of men, given it to mankind in common.'"[103] From these accounts of the origins of property, it can at least be

---

98. *Id.* at 145.

99. *Id.* at ch. 13 (discussing the influence of Grotius on the evolution of the law of nature); Bouckaert, *supra* note 2, at 787-88.

100. *See* READINGS IN JURISPRUDENCE, *supra* note 41, at 55-56. The debate over nature and origins of property did not end with the Papal intervention; it continued to be of interest to continental Christian theologians particularly in Spain in the sixteenth century.

101. BLACKSTONE, *supra* note 37, Book II at *2-*3.

102. JOHN LOCKE, TWO TREATISES OF GOVERNMENT, SECOND TREATISE ¶ 25 (Peter Laslett ed., Cambridge Univ. Press 1988) (1690).

103. *Id.*

argued that the first property rights in western philosophy were not only communal or public but also rooted in Christian doctrine.

The shift in the operating premise of the first occupancy principle raised two categories of problems. The first related to confronting the problem of creating private property from common property rights. The second concerned the impact of interjecting the supernatural or the divine into the concept of property. With respect to the first, explaining the transition from communal to private property became a task that would occupy the attention of philosophers and jurists. The idea that the assertion, "I was here first; I was the first to discover or invent this," would be sufficient to deprive society of its original claim to common ownership did not seem to flow naturally from the concept of common ownership. In that regard, Grotius found justification for the creation of property not in occupation *per se* but in many other supporting arguments.[104]

His first argument was necessity, induced by population explosion and scarcity.[105] But why would necessity or scarcity justify private property? Would the interest of society not be better served to deny the conversion of common property into private ownership in such difficult times? What would be the rational response of society to conditions of scarcity or necessity with respect to common property? Would society allow acquisitiveness, dominion, and exclusivity over common property? It is not obvious that the rational response of society to difficult conditions of scarcity would necessarily be to sanction the "*law of claw and fang or survival of the fittest.*"[106]

The second argument advanced by Grotius is based on some expressed or implied consent of humanity that occupation would confer property rights on the occupant.[107] The starting premise of the first occupancy doctrine does not easily permit the consent theory of property. For it appears almost impossible to procure the consent of all humanity with respect to any particular act of acquisition. It is not surprising that Grotius did not advance an argument for actual consent but rather for the supposition of consent.

His last argument was that it would be unjust to deny ownership to the occupant.[108] However, justice to the individual is a community concept that may not be sustainable in all cases of first occupancy. These arguments are of a utilitarian nature, and similar to those advanced by Blackstone.

According to Blackstone the first notions of private property were usufructuary, based on, and lasting with, possession and use. These rights were transitory in nature. Thus, the property returned to the common stock after use. However, as the

---

104. READINGS IN JURISPRUDENCE, *supra* note 41, at 57.

105. *Id.*

106. *Id.* (emphasis added). Grotius' argument seems to fit the roman law concept of *res nullius* better than it does common property. In the case of *res nullius* anyone may seize or occupy that which is not owned and insist on excluding other much more easily than if the thing seized or occupied is the common property of all humanity.

107. READINGS IN JURISPRUDENCE, *supra* note 41, at 58.

108. *Id.*

social and political organization of mankind increased in complexity, it became necessary to recognize permanent property rights on efficiency grounds.[109] He argued that continued recognition of the transitory and purely usufructuary rights in property would have significantly discouraged the evolution of a more convenient, commodius, and agreeable lifestyle. Similarly, John Locke found justification not in the occupation itself but in a theory discussed below.

The difficulties presented by the first occupancy theory to modern property theorists have been explored by property scholars such as Becker.[110] Given joint property interest, the creation of private property had to overcome objections from common or joint owners and a host of other problems. As noted above, for first occupation or acquisition to create property rights, the thing taken should not have been previously owned, but that premise could not be satisfied since all things were already jointly owned. Moreover, other justifications and arguments met with similar difficulties and Becker concluded that, at bottom, the first occupancy theory is empty and could only be supported if based on some utilitarian or other justification.[111]

While the introduction of the supernatural in the debate does not necessarily negate the existence of property, it nevertheless complicates the justifications for property. If God gave all things and creatures to humanity as common property, it might be instructive to examine the nature and scope of such a grant to determine whether there are divine law constraints on any private property regime that might be created. Common property might have been granted by God to achieve some divine objective such as ensuring the survival and propagation of the human species. If so, would God oppose a private property regime that seriously threatens the original divine objectives inherent in the initial grant? Assuming, however, that private property was contemplated by God as argued by Pope John XII, might there nevertheless be a category of things in the common stock so essential to the survival and propagation of the species that it must never be the subject of private ownership? These questions seem to be the same as those confronted by Roman jurists in a much more pragmatic secular arena. The difficulty presented here is that any justifications or limitations on property rights require some support from Christian theology and the interpretation of the Bible. However, the centrality and dominance of the Bible over other ancient religious texts is highly controversial.[112] To the extent that the divine or the supernatural plays some role in the creation of

---

109. BLACKSTONE, *supra* note 37, at *4.

110. *See generally* PROPERTY RIGHTS, *supra* note 9, ch. 3 (discussing the first occupation theory of property).

111. *Id.* at 30-31.

112. It should be noted that non-Christians may look to other Spiritual text such as the Koran for guidance on the question of the origins of property. Within each text there might be much controversy as demonstrated by the Franciscan debate over acquisitiveness and Christian morality. Eastern religions such as Buddhism may have an entirely different approach to the question of property and its application to ideas. Since this inquiry is limited to western legal systems and in particular, the United States, we shall not examine other philosophical approaches.

property rights, the determination of the nature and scope of those rights might be better left to theologians, ethicists, and philosophers of different faiths.

Perhaps, the shift from the secular to the divine has its most significant and direct implications on how biotechnological inventions and discoveries might be treated. It may be recalled that the function of biotechnological inventions, genetic engineering and the entire industry is the decoding, manipulation, and tinkering with life itself.[113] The goal might be to create new life forms, clone existing life, or extend life through genetic manipulation or by halting the aging process. Whatever the objective might be, the *created* (scientists) appear to have pretensions to being the *Creator.* From the theological perspectives it is doubtful whether God would tolerate such aspirations or even curiosity. For, we are reminded of the Old Testament story of the Tower of Babel erected on the plains of Shinar in Babylonia in an attempt to reach heaven. It is recorded in the Bible that the very presumption of reaching heaven through the tower angered God and He created confusion by introducing many languages immediately thereby ending the endeavor.[114] What the story of the Tower of Babel means is unclear and is a knot for biblical scholars and theologians to untie. However, others may consider the fundamental objectives of the modern biotechnology industry as following perilously close to the same foot paths as the descendants of Noah. The idea of human beings discovering and decoding the source of life and even creating life might be seen as presumptuous and being nothing short of pretensions of being God. Under such circumstances, the entire enterprise and its results might face condemnation.

On the other hand, even if the endeavors to create, sustain, extend, and manipulate life are not to be condemned, arguably God would demand that whoever is successful in this task be as generous as God Himself was. Such generosity would be best demonstrated by returning all inventions and discoveries to the common stock . Whether or not this argument can be supported is a question to be resolved by theologians, ethicists and philosophers.[115] Indeed, it is apparent from our

---

113. *Supra* notes 5-9 and accompanying test.

114. *Genesis* 11:1-9.

115. The ethical issues in biotechnological inventions is a subject that has occupied the attention of many religious leaders. For an example of concerns expressed about genetic engineering and medicine, see Pope John Paul II, *Dangers of Genetic Manipulation,* Address to the World Medical Association, October 29, 1983. He called for an unwavering respect for and protection of the integrity of human being in its totality and asserted that God alone is the master of human life and of its integrity. He argued that genetic intervention beyond the limits of therapeutic conduct is morally unacceptable. He said that genetic

> [i]ntervention must not infringe on the origin of life, that is procreation linked to the union, not only biological but also spiritual, of the parents, united by the bond of marriage. It must, consequently, respect the fundamental dignity of men and the common biological nature which is at the base of liberty, avoiding manipulations that tend to modify genetic inheritance and to create groups of different men at the risk of causing new cases of marginalization in society.

Id. Some see in biotechnological patents the seeds of greed and evil. *See* Joy Thompson, *A Spiritual Case Against Patenting Life Forms,* KNIGHT-RIDDER NEWS SERVICE, May 19, 1995 (expressing concern that patenting life forms is like playing God and scientists do not qualify for that title); Larry B. Stammer & Robert Lee Hotz, *Faiths Unite to Oppose Patents on Life Forms*, L.A. TIMES, May 18, 1995, at A1 (explaining that religious leaders are not

discussion so far that the issues raised by the developments in the biotechnology industry are complex and challenge many fundamental views.

The complexity of these issues is further increased by the interjection of the divine and the supernatural into the discussion of property. How these issues may be resolved would require serious and informed policy choices based on a vigorous and open debate of the relevant issues by interested parties.

C. *Locke's Labor Theory of Property*

One of the most hotly debated justifications for the creation of property rights is the labor theory of property, expounded by John Locke. In trying to determine the applicability of the labor theory to the protection of biotechnological inventions as property, a series of arguments needs to be made. First, there is a question as to the validity of the labor theory as a general theory of property. The issue of the general validity of Locke's labor theory has been the sport of philosophers, legal scholars, and students of government for centuries so it need not be repeated here. We are only interested in those aspects of the age-old debate which shed some light on the treatment of biotechnological inventions. Second, there is the issue of whether a labor theory of property that is applicable to tangible objects is equally applicable to ideas and the product of ideas. Last, assuming that the labor theory is applicable to ideas in general, should its application to biotechnological inventions be different, and, if so, why? The answers to these questions can best be tackled by examining the operating premises and substantive content of Locke's labor theory.

---

opposed to patenting biotechnological inventions except those involving human and human genes themselves); Mark Sagoff, *Patented Genes: An Ethical Appraisal,* ISSUES IN SCIENCE AND TECHNOLOGY, Spring 1998, at 37-41 (expressing the opposition of religious leaders to biotechnological patents in genes noting that religious leaders believe that human and animals are creations of God not humans and should not be patented; also explaining the position of religious leaders that patent policy should draw distinction between discovery and inventions and between what is in nature and the product of human ingenuity.); Sabra Chartrand, *A Human Gene is Patented as a Potential Tool Against AIDS, But Ethical Questions Remain,* N.Y. TIMES, Mar. 6, 2000, at C9 (describing the position of religious leaders, medical ethicists and scientist that the Human Genome belongs to the public). *But see* Editorial, *Patenting the Human Genome,* THE LANCET, Oct. 2, 1999 (arguing that it is too late to be concerned about the patenting of genes and the like because patents have already been granted for various life forms and that issues of access should be handled by the market.) The issue of ethics is not in the exclusive domain of religious leaders; *see* NOVARTIS Foundation for Sustainable Development, *Ethical and Ecological Aspects of Industrial Property Rights in the Context of Genetic Engineering and Biotechnology,* (visited Sept. 10, 1998) <http://www.foundation.novartis.com/genetic_ engineering_biotechnology.htm> (copy on file with the *McGeorge Law Review*) (adopting the ethical and ecological analysis of Professor Dr. Klaus M. Leisinger that the ethical issues in intellectual property rights are too complex and multi-cultural to handled by basic generalizations). For an academic discussion of the different types of ethics and their relationship to a pluralistic world community of scientists and researchers particularly on issues of the genetics, see David J. Roy et al., *Ethics for Complexity, in* HUMAN DNA: LAW AND POLICY 189 (Bartha Maria Knoppers, ed., 1997).

In his famous work, *Two Treatises of Government*,[116] John Locke offered an explanation of how private property came into existence—in language the full import of which can only be captured from two extensive quotations. First, Locke wrote:

> God, who hath given the World to Men in common, hath also given them reason to make use of it to the best advantage of Life, and convenience. The Earth, and all that is therein, is given to Men for the Support and Comfort of their being. And though all the Fruits it naturally produces, and Beasts it feeds, belong to Mankind in common, as they are produced by the spontaneous hand of Nature; and no body has originally a private Dominion, exclusive of the rest of Mankind, in any of them, as they are thus in their natural state: yet being given for the use of Men, there must of necessity be a means *to appropriate* them some way or other before they can be of any use, or at all beneficial to any particular Man.[117]

In the quoted passage, Locke was merely restating in his own terms long established views about the common grant of the world by God to humanity. What was unique was his explanation of how private property could be derived from common property. It may be recalled that in the Franciscan debates, Pope John XII maintained that God contemplated acquisition of private property in His common grant.[118] Centuries later, Grotius conditioned the creation of private property on the express or implied consent of society.[119] But making private property contingent on the consent of others meant that no property rights could be created in the face of an objection. Therefore, Locke sought to free the concept of private property from the grip of the consent requirement. Indeed, he argued that the product of labor was the property of the laborer without the assignation of consent from anybody. Notwithstanding all the abundance of nature and the common stock, humanity would have nevertheless starved if consent were required.[120]

The remedy was to be found in his labor theory of property that is captured in the following passage:

> Though the Earth, and all inferior Creatures be common to all Men, yet every Man has a *Property* in his own *Person*. This no Body has any Right to but himself. The *Labour* of his Body, and the *Work* of his Hands, we may say, are properly his. Whatsoever then he removes out of the State of that Nature hath provided, and left it in, he hath mixed his *Labour* with it, and

116. Locke *supra*, note 102, at ¶ 25.
117. *Id.*
118. TIERNEY, *supra* note 78, at 154-56.
119. READINGS IN JURISPRUDENCE, *supra* note 41, at 58.
120. LOCKE, *supra* note 102, at ¶ 26.

> joyned to it something that is his own, and thereby makes it his *Property*. It being by him removed from the common state Nature placed it in, it hath by this *Labour* something annexed to it, that excludes the common right of other Men. For this *Labour* being the unquestionable Property of the Labourer, no Man but he can have a right to what is once joyned to, at least where there is enough, and as good left in common for others.[121]

It is apparent from the quoted passage that Locke's labor theory of property was built on a series of arguments, suppositions, and assumptions. While the substance of Locke's arguments continues to be the subject of ongoing intellectual discourse, his suppositions and assumptions seem to command less attention.[122] Yet, the strength and weaknesses in Locke's theory might be inextricably linked to the operating premises of his theory. Because the mission of this Article is to invite a serious revisionist inquiry into the applicability of the concept of property to biotechnological inventions and discoveries, it seems appropriate to start this section with a discussion of Locke's operating premises.

1. Locke's Assumptions and Operating Premises

At the outset, it should be noted that Locke appears to attribute some *divine utilitarian* or *instrumentalist* motive to God in the common grant to humanity. The grant of the Earth and all in it was to serve three purposes: to facilitate sustenance or support, convenience or comfort, and to bring enjoyment to humanity.[123] Nature and its spontaneous production are but the *instruments* of God in the achievement of His divine utilitarian objectives since God made them available to humanity for the declared purposes.[124] However, God gave human beings reason to make the best use of the common grant, consistent with the divine utilitarian objectives. Thus, the exercise of human rationality in the acquisition and use of common property was to be guided by this external, qualitative normative standard. In other words, Locke seems to suggest that any regime of private property must be guided by and conform with the ultimate objectives of God in making the common grant. An acquisitive appetite that is motivated by greed, power, wealth for the sake of it, or some other similar human motive might trigger disapproval from the perspective of divine utilitarianism.

The notion of divine utilitarianism also suggests some internal limits on individual appropriation of common property. The terms *sustenance, convenience, and enjoyment* suggest limits on the human need to appropriate things. Any

---

121. *Id.* at ¶ 27.

122. Locke's assumptions have been commented upon by Becker. *See generally* PROPERTY RIGHTS, *supra* note 9.

123. LOCKE, *supra* note 102, at ¶ 25

124. *Id.*

acquisition of property should not exceed what is naturally necessary for one's sustenance, convenience, or enjoyment. Each individual is expected to know these limits and to adhere to them. Locke also imposed an internal check on acquisitiveness by demanding a focus on the needs of others when he argued that labor might create property "*where there is enough, and as good left in common for others.*"[125]

The internal limitations seem to be consistent with Locke's other assumptions and operating premises. For, Locke assumed that Nature imposes a limit on the scope and the product of human labor. He further assumed that there is a natural limit to human enjoyment of the fruits of labor. From these two limitations he concluded that the acquisition of private property through labor can never be total, nor would it ever encroach upon the rights of others. There will always be something left for the rest of society.[126] It is quite apparent that Locke could not conceive of a case where the acquisition of property rights could lead to a monopoly. Not only did he have a dim view of the technological capacity and potential of humanity, he was also overly impressed by the immenseness of the endowments of nature.

While such views might have been characteristic of the times, they were falsely predictive of human ingenuity and the capacity of nature to sustain the needs of an ever growing human population. Modern advances in science and technology have expanded the acquisitive capacity of humanity beyond what Locke could have imagined. It is now possible for a single individual to appropriate all, or substantially all, of a thing in certain discrete fields crucial to human survival. The advances in biotechnology, particularly those in genetics, make it possible for a single scientist to discover, manipulate, and appropriate the only pathway to a single cell constituting the only source of existence, to a critical pharmaceutical drug, or to some other human need.[127] The competition among scientists to map the entire human genome is not just a struggle for bragging rights, but perhaps more importantly for the ensuing property rights.[128] The fierceness of the competition

---

125. *Id.* at ¶ 27.

126. *Id.* at ¶ 35.

127. Davis, *supra* note 31.

128. While the international human genome project has made its findings available to the general public, Celera Corporation of Rockville, Maryland which was involved in the competition for mapping the entire human genome is reported to have filed thousands of provisional patents covering between 100 to 300 medically relevant genes. Reports indicate that Celera also plans to license genetic information to pharmaceutical companies for the development of products. *See* Editorial, *The Patent Problem,* ST. LOUIS POST-DISPATCH, Mar. 16, 2000, at B6 (discussing the issue and the statement of President Clinton and Prime Minister, Tony Blair of the United Kingdom that the findings of the human genome research should be made public and available to all). Note, however, that some have argued that issues of access to any information generated by the human genome project should be handled by the market under existing patent regime. *See* Editorial, *Patenting the Human Genome,* THE LANCET, Oct. 2, 1999, at 1135 (arguing that it is too late to deny patent protection to the findings of the human genome project since patents have already been granted for natural genome sequences of a nematode, two birds, one rabbit, a guineapig and a fish. No exception can be made for the human DNA by high minded politicians); Arthur Caplan & David Magnus, *Clinton-Blair Stand is Not End of Debate on Genome Patents,* THE INQUIRER, Mar. 20, 2000. The

confirms that the capacity and the desire exist for monopolistic acquisitive conduct or gaining gatekeeper rights in a field that concerns the very existence of life itself.[129] No industry captures the fears of such monopolistic acquisitiveness better than biotechnology.

In addition to the anti-monopoly restrictions, Locke imposed a non-waste requirement on his labor theory of property.[130] Locke considered it a punishable offense against Nature for a person to acquire property and waste it. According to Locke, a person is not entitled to more than he can use. But what does this condition actually mean? Does the laborer have property rights until the point of waste, or do the property rights exist only for those which can be used? Who determines the scope of such use? Furthermore, the examples used by Locke relate to perishable goods and one wonders how the non-waste condition might apply in the case of ideas in general and biotechnological inventions in particular. It should be noted that the term "waste" suggests a loss to both the laborer and society of the value of the property lost. In this connection, it is doubtful whether the non-waste condition is applicable to inventions and ideas which have a diffusible and non-depletable character. The fact that an invention is not used does not necessarily implicate a loss of its intrinsic value to its owner and society. It is therefore doubtful whether an invention is wasted if it is not used by its owner. On the other hand, the non-waste condition might demand greater access to ideas and inventions that are not being exploited by their owners. The waste lies in the denial of a valuable contribution to the needs of society possible in the exploitation of unused inventions.

The final condition imposed by Locke, of interest to us here, is the notion that labor should produce something of value.[131] This condition is particularly interesting in the case of biotechnology. While there is no doubt that many biotechnological advances have tremendous positive value to the inventors and society at large, there are questions about the long term impact of certain inventions. The genetic manipulation of seeds and recent advances in the creation of herbicide ready seeds and the so-called Terminator Seed raise questions about the impact of such

---

authors discussed the unfavorable market reaction to the statement by President Clinton and Prime Minister Tony Blair that the information of the human genome project should be put in the public domain. They also raised questions about the dangers and utility of denying patent protection based on the concerns over the abuse of patents. They claim that the real goal of the Clinton/Blair statement is to encourage cooperation between the private and public research groups. Chandler Burr, *Patenting Genes is Bad Medicine,* NAT'L POST, Mar. 21, 2000, Commentary, (explaining that the rush to map the human genome by companies such as Incyte and Celera is not about bragging rights but the amount of money that could be made. "If you get the patent for my version of that gene and then figure out how to deliver that good version to Gary's cells, where it then could do its gene job–making good enzymes–you'll be *rolling in money* . . . Right now it's a land rush, staking as many unsurveyed acres as you can, *figuring that at least in some of them you'll find gold.*") (emphasis added). Such is the argument of the author.

129. Burr, *supra* note 128.

130. LOCKE, *supra* note 102, at ¶ 37.

131. *Id.* at ¶ 40.

inventions on the ecological balance and long term health implications.[132] The idea that value should be created raises the question, "From whose perspective? From that of the inventor or society?" If we return to the instrumentalist and divine utilitarian views discussed earlier, one might question the existence of property rights if such rights would present a threat to nature, its ecological balance and diversity, and to the health and safety of humans. The inventions may undermine God's plans for humanity and the world. But the mere fact of a threat to society, the ecological balance in nature, the environment, or to specific categories of human beings is not necessarily dispositive of the issue of property rights. The nature, size, and depth of the danger presented may have a lot do with whether or not the rights should exist at all, and if so, only in a regulated form.

However, the question to be addressed is whether the assumed limitations are central to the viability of Locke's labor theory. If Locke's assumptions and operating premises are fundamental to the labor theory and they prove to be inaccurate or even of questionable validity, it becomes imperative to question the viability of the labor theory within the backdrop of the limitations. For instance, given the constantly expanding human capacity in science and technology, should certain subjects be excluded from the regime of private property because of a certain risk of monopolistic appropriation? Or would the divine utilitarian goals of providing every human being with free access to the means of sustenance, comfort, and enjoyment be served with a regulated monopoly over the sources of survival? Would human ingenuity and creativity vanish in the fields excluded from the property regime? These and other relevant questions are particularly important when we recall that the current fight over appropriable rents in biotechnological inventions is not about controlling *products* but the *pathways* to products. Monopoly over the pathways are much more *repressive and intrusive* than monopoly over products. The restrictions in monopoly over products are only product specific, whereas monopoly over ideas relating to the pathways to products imposes a broad ban on all from using their mental faculties in a specific way, even if the resulting products could be different.[133]

2. *Substance of Labor Theory*

Given the assumptions and conditions discussed above, Locke advanced a derivative theory of property based on the root idea that "every man has *property* in his own person [and] "[t]his nobody has any right to but himself."[134] Proceeding from this root idea, Locke argued that the labor of a person's body and the work of

---

132. *See* Nash, *supra* note 32, at 45 (discussing the yet unknown risk of genetic pollution, carriage of allergies and other risks from seed manipulation).

133. Tom G. Palmer, *Are Patents and Copyrights Morally Justified? The Philosophy of Property Rights and Ideal Objects*, 13 HARV. J. L. & PUB. POL'Y 817, 831 (1990) (discussing property rights in ideas).

134. LOCKE, *supra* note 102, at ¶ 27.

his hands are properly his own. But how does ownership of oneself and one's labor lead to the ownership of a thing? Locke answered that question with the argument that the mixing, joining, or annexing of one's labor with common property in its natural and raw state converts it into private property. The property loses its communal character or ceases to be part of the common grant, and the owner can, therefore, exclude all the commoners from it.[135] But it does not follow that the accretion of value from labor should not go to the commoners. As has been argued, why does the laborer not lose his labor rather than the commoners lose their property?[136]

Locke offered a series of arguments in response to this question. First, he argued that labor was commanded by God who rewarded the obedient and the industrious with property rights in the fruits of their labor.[137] Second, he argued that labor accounts for the substantial change (99%) in the value of the thing.[138] Essentially, he is arguing that ownership is based upon the fact that the increased value would not have existed without the exertion of effort, or the toils of labor. The commoners should not be entitled to that which neither existed nor would have existed prior to the mixing, or the annexing of labor with it. Finally, Locke asserted that it is just and fair for the product of labor to be appropriated by those who have toiled, or exerted themselves in creating the output.[139]

At its superficial and popular level, Locke's labor theory of property is powerful and easily appealing to those engaged in research and development in the biotechnology industry. The appeal of Locke's labor theory is even greater considering the meaning of labor in that context. Although Locke did not define labor, examples of activities he considered labor suggest that he had set a very low threshold for conduct that would constitute labor.[140] For him, the simple act of picking up acorns was sufficient labor to confer property rights over them. Measured by this standard, there is very little doubt that much of the research and development activities in the biotechnology industry would qualify as labor and the product of such labor would be privately owned. However, the simplicity of the labor theory tends to mask several difficulties in its application to ideas and their expression. To understand the complexity and difficulties of the labor theory of property one would have to start with an analysis of its root idea.

Notwithstanding its appeal, the labor theory of property presents certain difficulties of a fundamental nature that appear to undermine its central tenets. The argument advanced by the idea that every person has property in his own person cannot consistently be maintained with the idea that every person owns the product

---

135. *Id.*

136. Lawrence C. Becker, *The Labor Theory of Property Acquisition, Locke's Argument*, 73 J. PHIL. 653, 654 (1976) [hereinafter *Labor Theory of Acquisition*].

137. LOCKE, *supra* note 102, at ¶ 32.

138. *Id.* at ¶ 40.

139. *Id.*

140. *Id.* at ¶ 27.

of his laboring. According to Becker, without some adjustment in either argument, the two contentions are irresolvably contradictory.[141] The inconsistency in Locke's arguments might be illustrated with parents and children.[142] According to the root idea, children have a property interest in themselves and nobody can own them. However, the labor theory also asserts that every person owns the product of his labor. Accordingly, parents must own their children as the product of their labor. However, children own themselves and nobody can own them. Also, children cannot own themselves not being the product of their own labor. These inconsistencies may be resolved by saying that not all products of labor can be the subject of property.[143] If, therefore, in spite of the labor involved in the procreation and raising of children, parents do not own children as property, it must be that children fall into a category of the product of labor that cannot be owned.[144] This conclusion is neither surprising nor inconsistent with the assumptions, conditions and presuppositions discussed above. That is, not all the products of labor are always appropriable.[145]

While there is an obvious difference between children and other non-human products of labor, the question is whether the reasons for excluding children from the property regime can be extended to others. It has been suggested that Locke's idea of self-ownership was designed to guarantee individual liberty and freedom.[146] If this was the purpose of Locke's root idea, then it is relevant to investigate the question of whether certain biotechnological inventions or discoveries that deal with existence itself or the roots and the sanctity of life are not better excluded from the property regime. Such inventions may affect the right to life and individual liberties directly, or may do so indirectly by affecting the human environment.

If the root idea and its derivative property rights face contradictions in the case of tangible property, the inconsistencies appear even more severe in the case of ideas. As mentioned above, Locke's root idea was designed as a guarantee for individual freedom and liberty. As part of such a guarantee, Locke maintained that self-ownership was inalienable.[147] That is, a person could not *voluntarily* sell himself into slavery. It is, however, part of the exercise of liberty and freedom to think, to develop ideas, and to express them. The development of inventive ideas qualifies as labor and their expression as the product of labor. Palmer argues that granting property rights in ideas in the form of patents and copyright would result in contradictions similar to those found by Becker.[148] For instance, if two persons independently develop an invention, they both cannot own it in the sense that neither

---

141. *Labor Theory of Acquisition, supra* note 136, at 657.

142. *Id.*

143. *Id.* at 657-58.

144. *Id.*

145. *See* Palmer, *supra* note 133; Palmer stated "In a great society, not all labor is rewarded; and not all of the rewards of labor are in the form of property." *Id.* at 834.

146. *Id.* at 832-33.

147. LOCKE, *supra* note 102, at ¶ 23. *See also* Palmer, *supra* note 133, at 833.

148. Palmer, *supra* note 133, at 834.

of them would have the right to exclude all others from dealing with the invention as property.[149] Put differently, both of them would have the right to exclude each other and all others which would result in neither of them owning the invention. Moreover, if ownership is granted to them individually, one of them may make the invention available to all, while the other may prefer to exclude all others.[150] The exercise of these contradictory rights would also effectively cancel the property rights of the owner who prefers to exclude all others. According to Palmer, these contradictions are irresolvable without some modification of one of Locke's arguments.[151] Modern patent statutes seem to have resolved the contradictions by granting patent protection only to the first to file. Thus, even though the two inventors would have both "labored" in producing the patentable invention, only one of them would be rewarded with protection and property rights. Under such circumstances, the grant of property rights cannot be based solely on labor but on some other social policy. Also, perhaps equally important is the inference from modern patent policy that not all products of labor are patentable or can be appropriated.

Besides, it has been suggested that the guarantee of individual liberty and freedom carries with it the right to develop and express one's ideas in the form of patents, copyright, or in some other way.[152] However, under the labor theory, conferring property rights on ideas would restrict the freedom of thought and expressions guaranteed by the root idea.[153] The restrictive impact of property in ideas is likely to be much more severe than that of tangible property. In the case of tangible property, the right to exclude others from a specific item does not necessarily extend to other items of the same type. Therefore, the right to exclude others is not total and pervasive. However, with respect to ideas, the right to exclude all others from an idea may shut the door to the expansion of human knowledge which may be the source of specific inventions and innovations.[154]

As property rights are granted to an increasing number of specific and discrete pathways in biotechnological discoveries and inventions, access to such pathways would become increasingly difficult. This phenomenon has been recently described by Michael A. Heller and Rebecca S. Eisenberg as the tragedy of the

---

149. *Id.* at 830.
150. *Id.*
151. *Id.* at 834.
152. *Id.* at 828.
153. *Id.* at 831 (arguing that intellectual property rights restrict liberty).
154. *Id.* Palmer argued:

> My ownership claim over my computer restricts your access to *that* computer, but it is not a blanket restriction on your liberty to acquire a similar computer, or an abacus, or to count on your fingers or use a pencil and paper. In contrast, to claim a property right over a process is to claim a blanket right to control the actions of others.

Id. (emphasis added).

anticommons.[155] The proliferation of rights might inhibit creativity and the development of root ideas and first principles without which specific inventions would be less likely. Again, applying the labor theory without any adjustments would lead to unresolvable contradictions (restrictions on freedom of thought and expression) and a negative impact on the free development of ideas. Humanity would be worse off with a property regime that could result in the ultimate control of the access to knowledge in general and particularly in a field as important as biotechnology.

The inconsistencies between the root idea and the derivative theory of property also have significant implications for the advances being made in human biological and biochemical sciences. The concept of self-ownership in Locke's root idea raises the questions whether each person has property in his body parts, organs, cells, DNA, and even bodily wastes. Does the idea of self-ownership translate into property rights in discrete parts of the body in the sense that they can be the subject of exclusion and transactions? In other words, can the human body as property be a commodity to be traded by its owner? The answer to these questions may depend on what Locke meant by the term "property" in the root idea. If the term "property" carried with it all the rights and incidents generally associated with ownership, then the human body, body parts, cells, and so on, could be the subject of commercial transactions. Scientific information and data derived or generated from the human body would also be proprietary. However, it is doubtful if Locke intended such use of the term "property." For, would the commodification of the human body not undermine the very purpose of Locke's root idea of guaranteeing liberty, freedom and human dignity? Would it not also pose serious dangers "to the erosion of the sanctity of human life, . . . autonomy [and] privacy"?[156] One might argue the dangers referred to here need not materialize since a regulatory scheme might be established to eliminate or minimize them. Even so, a regulatory scheme no matter how rigorous may not be the most effective remedy to address those dangers.

On the other hand, the risk to human dignity and the sanctity of the human body might be significantly less if the term "property" meant something else. According to Becker, one could interpret the term "property" in Locke's root idea to be limited to the right to exclude others from interfering with or dealing in the human body.[157] Such a limited use of the term "property" would appear consistent with Locke's objective of guaranteeing individual liberty and personal freedom. Recall that self-ownership did not permit an individual to subject himself voluntarily into slavery. If Locke had intended the term "*property*" to be used in its full-blown form, he would not have imposed such a limitation on self-ownership. It would therefore appear that a more restricted interpretation of the term "property" is plausible and might provide a solution to the dangers outlined above.

---

155. Heller & Eisenberg, *supra* note 1, at 700.

156. Litman, *supra* note 8 at 17, 21.

157. PROPERTY RIGHTS, *supra* note 9, at 37.

3. Labor Theory and Ownership of the Human Body

The ambiguity in the use of the term property in Locke's root idea further complicates the legal issues raised by advances made in the fields of biotechnology and biomedical research. It is well settled that the successful development of new cell lines, gene therapy, and other biomedical techniques or pharmaceutical products based on human materials can result in significant financial rewards to researchers, hospitals, and biotechnology companies.[158] There is little doubt that the biotechnology industry is a billion dollar industry that attracts significant financial resources and human endeavor.[159] Because the biotechnology industry is characterized by high risks and high returns, researchers, scientists, and their supporting institutions are clamoring for an expanded property regime to protect their investments.[160] However, high returns have also attracted similar assertions of property rights in human donors of the raw materials used in the development of the new treatment techniques, inventions and pharmaceutical products. [161]

At the heart of these competing claims is Locke's labor theory of property. As mentioned above, a restricted reading of Locke's root idea would lead to the conclusion that human donors, other than the right of exclusion, have no property rights in their persons or in their cells, tissues, body parts, and other human raw materials used in financially lucrative inventions.[162] Ascribing such a limited meaning to the term property raises the question of whether the same limitations on the property concept should be imposed on claims of ownership of the inventions and innovations derived from human raw materials. If, on the other hand, we assigned to the term property its normal meaning the human supplier would have property rights in his own person and also in the human raw materials such as blood,

---

158. *See generally* Bowe, *supra* note 12; *supra* notes 13-21.

159. *See generally* Lawrence M. Fisher, *supra* note 18.

160. *See supra* note 128 and accompanying text. The expansion in property rights in biotechnological inventions is perhaps best illustrated by the proliferation of patents covering gene fragments, called "*expressed sequence tags or ESTs.*" ESTs are controversial patents since they are only part of a gene or gene fragments with no known at the time of filing. But they are only used to identify and isolate other genes. In essence they are hunting licenses given to the patentee. In 1991, the National Institute of Health filed a patent application 347 gene fragments and since then the desire to obtain ESTs patents seems irresistible. It is reported that since 1977 there has been at least 350 patent applications covering 500, 000 tags and the largest application contains about 18,500 sequences. For a discussion of the problems presented by the ESTs patents see Dale B. McDonald, *Who Owns Nature?*, FARM INDUSTRY NEWS, Mar. 1, 1999. Concerns over the patentability of ESTs is not limited to the United States. They have been expressed in the United Kingdom where The British Group of AIPPI, a non-governmental organization for research into the formulation of policy, has offered some guidance on how ESTs, single nucleotide polymorphisms (SNPs) and entire genome might handled under patent law. *See* The British Group AIPPI, *Report Q 150: Patentability Requirements and Scope of Protection of Expressed Sequence Tags (ESTs), Single Nucleotide Polymorphisms (SNPs) and Entire Genomes*, 22 EUR. INTELL. PROP. REV. 39 (2000) (arguing that ESTs, SNPs, and entire Genomes could meet the patentability test of utility, inventiveness, novelty, non-obviousness, and sufficiency).

161. *See* Litman, *supra* note 158, at 20-27 (discussing the different legal theories and policy options for treating human genetic material and bodily parts as property).

162. PROPERTY RIGHTS, *supra* note 9, at 37.

body fluids, cells, body parts, or even waste used in research. However, ownership in one's body and its cells or parts does not necessarily translate into ownership of the derivative products generated and developed from those human raw materials. Quite often the finished product, even though it could not have been developed without the specific human raw materials, is nevertheless significantly different from these raw materials. Would such a difference justify conferring property rights on the inventor rather than on the human donor of the raw materials? However, given that the inventor and the donor have both contributed something towards the end results might there be a sound policy basis for recognizing a joint property interest? These were some of the questions confronted by the California Supreme Court in the famous case of *Moore v. Regents of the University of California* (*Moore*).[163]

The facts in *Moore* were simple and non-controversial but the conclusions of the Court have evoked a significant debate. Moore, the plaintiff, alleged, inter alia, the conversion of his possessory and ownership interest in his blood, bone marrow aspirate, and other bodily substances extracted by his physician during a treatment of his leukemia. Unknown to the plaintiff, tests had revealed that his blood had certain unique properties attractive for scientific and competitive commercial exploitation. His physician designed a treatment program that required the plaintiff to make several visits to the University of California, Los Angeles Medical Center where his bodily substances including his spleen were extracted, in part, to foster the research interests of the physician. Without his knowledge or consent, the plaintiff's bodily substances were used in research resulting in the development of a cell line patented by The Regents of the University of California.

In a weakly reasoned opinion, a majority of the California Supreme Court rejected Moore's claim of conversion offering several justifications which had little bearing on the essence of property. The Court started its analysis by noting that under the common law, the precondition to conversion is the existence of some property interest of the plaintiff in the subject matter of the conversion.[164] Unfortunately for the plaintiff, the Court found that he did not have the requisite property interest in his excised bodily substances upon which the theory of conversion could be founded.[165] However, a careful reading of the Court's reasoning suggests that the rejection of Moore's claim of conversion did not resolve the basic issue of ownership of one's body. The Court was very careful in the way it framed its conclusion. It said: "Since Moore clearly did not expect to *retain possession* of

163. 793 P.2d 479 (Cal. 1990).

164. *Id.* at 487.

165. *Id.* at 489. The Court offered three reasons for denying the conversion claim: no precedent; California statutes restrict continuing ownership interests; and the subject matter of the patent "cannot be Moore's property." *Id.* Having so found, the Court concluded that Moore's claim "must frankly be recognized as a request to extend [conversion.]." *Id.* at 493. The Court denied the extension based on three reasons: policy considerations; area better suited for legislative action; and there are other means available for protecting the rights of patients. *Id.*

his cells following their removal, to sue for their conversion he must have *retained an ownership interest* in them."[166]

The operative phrase in the quoted passage is "*retained ownership interest.*" The implicit suggestion of the Court from using the term "*retain*" is that Moore had ownership and possessory interest in his body and its constituent parts prior to their removal. One may ask what the majority could have meant by the phrase *possessory and ownership interest.*[167] The answer to this question, oddly enough might be found in the dissenting opinion of Justice Mosk when he expressed the policy considerations behind ownership of one's own body in these words:

> In any event, in my view whatever merit the majority's single policy consideration may have is outweighed by two contrary considerations, i.e., policies that are promoted by recognizing that every individual has a legally protectible property interest in his own body and its products. First, our society acknowledges a profound ethical imperative to respect the human body as the physical and temporal expression of the unique human persona. One manifestation of that respect is our prohibition against direct abuse of the body by torture or other forms of cruel or unusual punishment. Another is our prohibition against indirect abuse of the body by its economic exploitation for the sole benefit of another person. The most abhorrent form of such exploitation, of course, was the institution of slavery. Lesser forms, such as indentured servitude or even debtor's prison, have also disappeared. Yet their specter haunts the laboratories and boardrooms of today's biotechnological research-industrial complex. It arises wherever scientists or industrialists claim, as defendants claim here, the right to appropriate and exploit a patient's tissue for their sole economic benefit—the right, in other words, to freely mine or harvest valuable physical properties of the patient's body: "Research with human cells that results in significant economic gain for the researcher and no gain for the patient offends the traditional mores of our society in a manner impossible to quantify. Such research tends to treat the human body as a commodity—a means to a profitable end. The dignity and sanctity with which we regard the human whole, body as well as mind and soul, are absent when we allow researchers to further their own interests without the patient's participation by using a patient's cells as the basis for a marketable product." [168]

The concern expressed by Justice Mosk is not that a person does not have property rights in his own body. For, he noted "every individual has a legally protectible

166. *Id.* at 488-89 (emphasis added).
167. Note that this is the phrase that the Court used in framing Moore's claim of conversion. *Id.* at 487.
168. *Id.* at 515-16.

property interest in his own body and its products."[169] His concern was, rather, that a person could be allowed to exploit the body of another for profit to the exclusion of that person. If, therefore, ownership carried with it all the usual implications of the term, then Moore had the right to determine the conditions of access to his bodily substances before and after their removal. His property rights would not have terminated merely because of their removal, but rather based upon the terms of removal. As it was maintained by the dissent, Moore would have had an interest in the commercial exploitation of his bodily substances just as much as his physician[170] unless he deliberately gave up that interest. It is unclear from the majority's opinion how Moore lost his property rights.

The majority relied on regulatory statutes that were not intended to have, nor had, direct application to the creation, qualification, or loss of property rights in human body parts.[171] The Court also seemed to argue that Moore lost his rights because he consented to the removal of his bodily substances. However, consent is not dispositive of the issue of retention of ownership. Consent, obtained through misrepresentation or fraud to have bodily substances extracted does not necessarily transfer ownership to Moore's physician even though he might have had possession. Possession and ownership are not always coincident. The remedy for Moore should include conversion and does not lie exclusively in action for breach of fiduciary duty, the duty to disclose (informed consent) or perhaps fraud as suggested by the majority.[172] It is clear from the foregoing that the Court's opinion is muddy at best and contradictory at worst. For, the idea that Moore did not retain ownership interest was unsupported by property theories and even contradictory to the notion of prior ownership.

The majority opinion also raises other significant policy questions about the ownership of patentable inventions and innovations derived from human bodily substances. Notwithstanding the serious policy ramifications of the case, the Court appeared willing to offer a bright line rule on the ownership of derivative patents and products rejecting any claims of ownership by Moore in the following words:

> *[T]he subject matter of the Regents 'patent—the patented cell line and the products derived from it—cannot be Moore's property.* This is because the patented cell line is both factually and legally distinct from the cells taken from Moore's body. Federal law permits the patenting of organisms that

---

169. *Id.* at 515.

170. The interest of Moore in the commercial exploitation of his bodily parts can best be seen from the discussion of the Court of the financial benefits to be reaped from the Moore cell line. The profits were estimated to exceed $3 billion by 1990. And these profits would be shared by all in the industry excluding the human donor. *Id.* at 516.

171. The statutes that seemed to guide the Court were: Health and Safety Code (various sections), Uniform Anatomical Gift Act, and Government Code § 27491.46 (right of coroner to retain certain bodily parts during autopsy). *Id.* at 489.

172. *Id.* at 483.

> represent the product of "human ingenuity," but not naturally occurring organisms. Human cell lines are patentable because "[l]ong-term adaptation and growth of human tissues and cells in culture is difficult—often considered an art . . . ," and the probability of success is low. It is this inventive effort that patent law rewards, not the discovery of naturally occurring raw materials. *Thus, Moore's allegations that he owns the cell line and the products derived from it are inconsistent with the patent, which constitutes an authoritative determination that the cell line is the product of invention.* Since such allegations are nothing more than arguments or conclusions of law, they of course do not bind us.[173]

The categorical statement that Moore did not have property rights in the patented cell line and products derived from it together with the earlier conclusion that Moore lost ownership interest in his extracted bodily substances have significant policy ramifications. First, there is the obvious suggestion that the researcher who extracts bodily substances from a person has greater rights in those substances than the donor. Implicit in the Court's opinion is that it would have recognized the property rights of the UCLA medical center in those bodily substances—even if they had been stolen by someone, even if the thief was Moore himself. An analysis that denies Moore prior property rights in his bodily substances but nevertheless allows his physician to acquire such rights from Moore would be violative of the well established legal principle which states, "*nemo dat quod non habet*" (One cannot give that which he does not have).

Second, a policy that allows *only* the researcher to have post extraction property rights in the substances and all derivative inventions and products seems patently unfair. The inequities created by the majority's position was addressed by Justice Mosk in the following words: "[o]ur society values fundamental fairness in dealings between its members, and condemns the unjust enrichment of any member at the expense of another. This is particularly true when, as here, the parties are not of equal bargaining positions."[174] The inequities and injustice seemed magnified in the specific case at hand where the invention derived from Moore's bodily substances yielded over $3 billion which was shared *exclusively* between the universities and the biotechnology industry.[175] Recognizing legally protected property rights in the donor's body and its products would not necessarily deny the inventor property rights but would facilitate or even compel the sharing of such profits and eliminate the unjust enrichment inherent in the majority's position.[176] The goal of most legal systems include the development of a system of rights built on an edifice of distributive equities to foster respect of the system and the internalization of its

---

173. *Id.* at 492-93 (emphasis added).
174. *Id.* at 516.
175. *Id.*
176. *Id.*

values by society at large. Such a goal is undermined by a judicially created legal principle that is, or appears to be, patently unjust.

Third, the Court treats the grant of a patent as conclusive of the transformation of the raw material and ownership in the inventor.[177] However, the grant of a patent is neither conclusive of the transformation of the raw materials into patentable new materials nor conclusive of ownership. After all it was Moore's physician and a colleague who invented the cell line but the patent was taken out by the Regents of the University of California.[178] The actual inventor did not hold property rights thus it would not have been necessary for Moore to have been the inventor to hold property rights in the patented cell line. Moreover, suppose Moore had not consented to the extraction of his bodily substances used in the patentable invention, who would have owned the patent? Or suppose a thief had stolen those substances from the UCLA laboratories and had used them to invent the cell line, would the Court have been so certain about the ownership of the invention by the inventor thief? In the case at hand, Moore contributed something to the enterprise without which the finished product would not have been possible. As long as the Court was wedded to the notion of property rights, it appears fundamentally inequitable and immoral for it to have categorically excluded Moore from those rights without a complete analysis of the underlining property theories.[179]

Finally, the Court expressed great concern about the impact on research and development and society if Moore were given property rights in his bodily substances and their derivative inventions and products.[180] However, Justice Broussard found the majority public policy position seriously flawed. According to him the majority position did not square with the concerns it expressed about the interest of society in Research and development and inventiveness. Given such concerns, the logical conclusion of the majority would have been to advocate putting the extracted bodily substances and the resulting inventions in the public domain

177. *Id.* at 493.

178. *Id.* at 481-82. Quite often an employment contract will assign all rights in any invention and discovery by an employee to the employer thereby making the employer owner of such invention or discovery. That appears to have been the case with Dr. Golde and the University of California Los Angeles Medical Center.

179. Justice Mosk in his dissent cited opinions of an ethicist who argued that "the person [who furnishes the tissue] should be justly compensated . . . If biotechnologists fail to make provision for a just sharing of profits with the person whose gift made it possible, the public's sense of justice will be offended and no one will be the winner." *Id.* at 516. He therefore concluded that failing to compensate the patient who provided the raw materials would be morally unacceptable, unfair and result in unjust enrichment. *Id.*

180. The Court listed a parade of problems that would befall the system should the theory of conversion be sustained. There would be (1) restrictions on access to raw materials, (2) scientific exchange would be compromised, (3) liability will be expanded, and (4) researchers would be purchasing a ticket in litigation lottery each time they obtain human raw materials. *Id.* at 484-96.

and not create a private exclusive domain for them. Justice Broussard expressed his concerns in the following words:

> It is certainly arguable that, as a matter of policy or morality, it would be wiser to prohibit any private individual or entity from profiting from the fortuitous value that adheres in a part of a human body, and instead to require all valuable excised body parts to be deposited in a public repository which would make such materials freely available to all scientists for the betterment of society as a whole.[181]

Justice Broussard's argument merely underlines the serious nature of the policy considerations facing the treatment of biotechnological inventions. Because biotechnology seeks to decode, manipulate, or create life itself, it raises issues of such a fundamental nature that cannot easily be addressed by simple linear policy analysis. The fundamental policy issues are magnified when the target of biotechnology is human existence. The human body and its components or constituent elements are not simply scientific facts, or raw materials for genetic engineering, transgenic manipulation, or gene-therapy. Human cells, plasma, and genetic materials constitute something larger than their scientific basis. They are living organisms and constituent parts of life which continue to be a mystery and part of a larger universe of theology and nature. How the human body and its constituent parts might be treated should therefore be guided by policies that display great depths of sensitivity to theology, moral philosophy, and ethics. A property regime with its focus on exclusivity, dominion, and alienability might be *unsuitable* for the human body, or body parts. The concept of property, like other legal concepts, is an instrument. We must pause and ask the role of property in relation to the human body. If we exclude the human body from the regime of property in the full sense of the term, it cannot be that the human body *cannot* be owned but rather that it *should not* be owned because of the sanctity of the human body. If, however, we made the policy choice to treat the human body as property then we *must* apply that concept fairly and consistently.

4. Summary

Of all the traditional property theories that could support property rights in biotechnological invention none appears as attractive as Locke's labor theory of property. The idea that a person is entitled to the fruits of his labor is both simple in its conception and intuitively appealing to those engaged in Research and development in the biotechnology industry. The task of genetic engineering is neither simple nor cheap. The process of developing biotechnological inventions

181. *Id.* at 505.

which often require a complex set of sequences and involve time consuming and painstaking activities certainly qualify as labor. At the popular level, ownership of the results of such labor appears rational and fair. However, the issue is not whether the labor theory of property can be applied to biotechnological inventions but rather whether all products of labor must be protected as property. From the philosophical and technical level one cannot conclude that every product of labor including patentable inventions qualifies as property. As has been demonstrated in this section, the labor theory of property is built on assumptions, suppositions, and conditions not always fulfilled irrespective of the amount of labor involved. Thus, notwithstanding a significant amount of labor involved, property rights may fail because the preconditions fail to be met.

Moreover, even as a substantive matter, not all products of labor constitute property and not all property is the product of labor. For instance, children are not the property of their parents in spite of the labor involved the procreation and raising of children. And children do have property rights in themselves not as a result of any labor on their part. What therefore motivates the qualification of labor whereby certain products of labor are removed from the property regime? And why is it that property rights exist even without labor? Might certain biotechnological inventions be excluded from the property regime because of their fundamental importance to life, liberty, human dignity and the maintenance of an ecological balance? Advances in biotechnology invite a much more deliberate examination of the labor theory of property to determine its applicability to the products of labor in that industry.

D. Utilitarian Theories of Property in Biotechnology

One of the basic and fundamental justifications for property rights can be found in utilitarian philosophy. Utilitarian philosophers offer an instrumentalist explanation of property. To them the creation of property rights is not an end but a means to an end: the achievement of happiness or the minimization of transaction costs. Utilitarian justifications for property fall into two categories: (1) traditional utility and, (2) economic utility. Because these two variants of utilitarianism offer different approaches to and explanations for the existence of property their ramifications for biotechnology are likely to be different, thereby warranting separate analysis.

1. Traditional Utilitarianism

In concert with its instrumentalist objectives, traditional utilitarian justifications of property assert that the end of private property rights is happiness.[182] The guarantee of security of possession, use, and consumption accorded to property

182. *See* PROPERTY RIGHTS, *supra* note 9, at 57.

operates as incentives for human acquisition, possession, and use of a thing for the achievement of happiness. So basic are the tenets of traditional utility that Becker has argued that they lie at the core of any justification of property rights.[183]

Traditional utility based instrumentalist theory of property is constructed on three related arguments all aimed at the goal of achieving happiness. The first of the arguments is that security of possession, use, and enjoyment of a thing does not only lead to the attainment of happiness but also is a fundamental good.[184] Such a fundamental good should not be undermined by insecurity of possession. The second argument is based on necessity.[185] Essentially, property rights are seen as necessary for the achievement of happiness. A stronger version of the necessity justification might be that property rights are a *sine qua non* for happiness. But why is that? Arguably because human beings have such a persistent need for property rights, it would be unjustifiable to deny them such rights unless there is some compelling countervailing good.[186] The last argument is based on a balancing of property rights against other societal interests.[187] In other words, on the balance, it would be best for society, as a whole, to recognize property rights unless there are significant countervailing reasons not to do so.

2. *Traditional Utilitarianism and Property Rights in Biotechnology*

The philosophical utilitarian arguments for property rights summarized above while complex and interesting, shall not detain us here. Our interest is limited to the policy issues they raise within the context of biotechnological discoveries and inventions. As a policy matter, how might a society confronted with the advances made in biotechnology decide the issue of property rights based on the instrumentalist goal of happiness? Any reliance on happiness as a determinant of property rights will run into several difficulties. First, the concept of happiness is as elusive as it is insusceptible to easy definition and measurement. Happiness is a subjective phenomenon induced by a multiplicity of conditions not always the subject of objectification. Second, there is the question of whose happiness should be the focus of an instrumentalist theory of property. Should it be that of those involved in the tedious research and development work that results in new biotechnological products, or should happiness be measured by the general benefit to society at large? If we rely on the benefits to society, how might those be identified? For instance, in the case of genetically modified foods, there is a growing public disapproval of them almost bordering on uninformed hysteria. Should such public fear, even if there is no scientific basis for it, be indicative of "no happiness,"

183. *Id.* at 59.
184. *Id.* at 64-65.
185. *Id.* at 65.
186. *Id.* at 66.
187. *Id.*

thereby forming the basis of the denial of property rights? Finally, if happiness is to be promoted by the creation of property rights, who should hold such rights, of what quality, and for what duration? If we conclude that general societal welfare is the objective, would private ownership better serve that goal than communal ownership?

The seriousness and complexity of the policy considerations required in confronting the instrumentalist goals of traditional utilitarianism are not lessened with respect to the second and third arguments based on necessity and societal benefits respectively. The suggestion is made in the second argument that the desire for property rights are inherent in human nature.[188] Absent some compelling reasons, society should not contravene such inherent human tendencies towards private property rights. However, we are not told what would qualify as justifiable reasons for denying property rights. Thus, would fear, uncertainty, or public disapproval of a biotechnological invention be sufficient reason to deny property rights in it? Or must there be a demonstrable danger or risk to human health and safety or to the environment? Suppose an invention is so important to society at large but the grant of property rights would create a monopoly, would that be sufficient justification for denying property protection? Moreover, would property rights be justified by the cost, level of difficulty, or significance of the invention involved? Similarly, the argument that, absent some countervailing good, society is better off recognizing specific property rights raises parallel policy questions; the answers to which require a much more deliberate and discriminating analysis of the biotechnology industry.

The biotechnology industry is not a monolithic entity to which a single comprehensive policy might apply with ease. Rather, it is a complex industry with different interests, different operations, and differentiated impact on society as a whole. As such, any policy design to assign private property rights in biotechnology must be sophisticated and take these differences into account. A starting point for understanding the complexity of the biotechnology industry is to classify the activities into their relevant categories. One might divide the biotechnology industry into five broad sectors. The first involves life sciences devoted to the study of, and innovations in, human genetic structures which can be used for medical and non-medical purposes.[189] The second sector is also devoted to the study of non-human life sciences.[190] Research and development in this field may be directed at changing the basic characteristics of certain animals by manipulating their hormones or altering their genetic structures at the cellular level for various purposes. For instance, the purpose might be to design genetically better tasting and tender beef, improve the milk production of cows, or to create a new species of exotic animal or flower. In the third sector, we have biomedical operations which are directed at using the innovations in human and non-human sciences to develop new medical

188. *Id.* at 64-65.

189. *See supra* note 6 and accompanying text.

190. *See supra* note 7 and accompanying text.

treatments such as gene therapy, transgenic cloning for the production of proteins or the development of organs for human transplantation.[191] The fourth sector is devoted to the development of biotechnology-based pharmaceutical products.[192] The fifth sector involves the use of biotechnological techniques such as seed and plant genetics for the development of new breeds or hybrid varieties of seeds and plants.[193]

Whether property rights might be recognized in any of these areas would require separate analyses and policy justifications. For instance, in the case of innovations and inventions involving human life sciences, the issue of creating property rights raises serious political, ethical and economic implications already discussed above. The risk to human dignity and liberty might outweigh any benefits in the form of happiness that property rights might bring. Moreover, granting exclusive property rights over the pathways to cloning of human beings or even for the creation of human life *de novo* might reintroduce slavery, serfdom and other forms of human indignities now positively condemned by the Declaration of Human Rights.[194] In the case of biomedical and pharmaceutical inventions, justifying property rights based on the welfare or happiness of inventors and their financiers also presents significant risks. The exploitation of medical and pharmaceutical advances might be dictated purely by profit motive and not by the medical necessity of the most needy segments of society.[195] Thus, a medical culture favoring the affluent and the powerful would emerge, in which research expenditures would not necessarily be directed at the most difficult and needy medical areas. Considerations of class, race, ethnicity, and wealth would be the primary determinants of biomedical and pharmaceutical research and marketing efforts. We are already currently confronted with the situation in which *proletariat diseases* and those most prevalent in developing countries receive little or no attention from the major biomedical and pharmaceutical

---

191. *See supra* note 7-9 and accompanying text.

192. *See supra* note 7-9, 24 and accompanying text.

193. *See supra* note 27-28 and accompanying text.

194. In particular, the following Articles of the International Declaration of Human Rights should be of interest to us in any discussion of the implications of the advances made in biotechnology." Article 3, Everyone has the right to life, liberty and the security of person. . . . and slave trade shall be prohibited in all their forms. . . . inhuman or degrading treatment or punishment. . . . a person before the law. INTERNATIONAL DECLARATION OF HUMAN RIGHTS, *Adopted by United Nations General Assembly,* Dec. 10, 1948, 3 U.N. GAOR, I, at 71, U.N. Doc A/810 (1948).

195. The pursuit of profit and the exploitation of the most lucrative biomedical advances would be the logical consequences of the privatization of research in these areas. The shareholders would demand that research and the exploitation of the results enhance the market value of their companies. And based on corporate law principles the board of directors of the companies would be expected to act in such a way as to improve the valuation of their companies. Indeed one commentator has suggested that pharmaceutical companies are not interested in finding the cure for cancer since that might lead to government intervention and less profits. *See* Lester C. Thurow, *Poaching Patents,* CAL. LAW., Nov. 1999, at 24.

global enterprises.[196] Current developments in the biotechnology industry appear to bring some of these issues to the forefront and invite the adoption of a revisionist property policy analysis.

a. Monsanto and the Corporate Strategy for Dominance in Biotechnology

As a general matter, recent advances in agrobiotechnology have attracted both positive and negative attention from many sectors of society and Monsanto has been in the eye of the hurricane. To some, genetic engineering of seeds, plants, fruits and other agricultural products provide the tools for eliminating the curse of hunger from the face of the earth.[197] Biotechnology is not only touted as providing the technology

---

196. Diseases that are prevalent mostly in developing countries have received very little attention from the research departments of drug companies. *See* Tim Vollmer, *Disease in Poor Countries Get Short Shrift from Drug Companies Focused on the West's More Lucrative Ailments*, S.F. CHRON. June 25, 2000, at 1. According to the author, pharmaceutical companies aim their research efforts at developing new drugs for affluent markets. For instance, 80% of pharmaceutical sales are made in North America, Europe, and Japan. Africa accounts for only 1%. Between 1975 and 1997 there were 1,233 new medicines were patented. Of this number only 13 or 1% were for tropical diseases. Malaria is a tropical disease that affects between 300 to 500 million people each year yet the medicine for malaria is 40 years old and the disease has been able to mutate in response to medication. Yet no research effort is put into the development of a new drug. Sleeping sickness is another disease caused by the tsetse fly. The medicine for this disease which is comprised of antifreeze and arsenic was developed 70 years ago and no company appears willing to pump research funds and effort into developing a new treatment. *See also Millions for Viagra, Pennies for the Poor*, TRONTO STAR, Aug. 13, 1999. This is what this news paper wrote about the attention paid to diseases in poor countries: "One old, fat, bald, fungus-ridden rich man who can't get it up means more to the pharmaceutical industry than half a billion poor people vulnerable to malaria. . . . Malaria, tuberculosis, acute lower respiratory infections claimed 6.1 million lives in 1998. People died because the drugs to treat those illnesses are non-existent or are no longer effective. They died because it doesn't pay to keep them alive . . . on malaria alone, a recent survey of the 24 biggest drug companies found that not a single one maintains an in-house research program, and only two expressed even minimal interest in primary research on the disease."(emphasis added); Patrick Bishop, *Why Poor People are Worth less than Animals*, DAILY TELEGRAPH (LONDON), Mar. 24, 1999, at 24 (posing the question whether impotence or pneumonia that kills millions of people particularly children is the bigger problem, and also arguing that some of the very few medical patents for tropical diseases were spin-offs from research into animal rather than human diseases). The general issue of the lack of research effort in diseases of the poor was brought to the forefront by a controversial statement made by President Thabo Mbeki of South Africa at the 13th World Aids Conference on AIDs about the causes of AIDs and the availability of drugs to poor nations. For instance, *see generally* Alex Duval Smith, *AIDs SUMMIT: Drug Companies 'Inflicting Holocaust on the Poor'; Anti-Capitalist Rhetoric Deflects the Spotlight from South African President's Mishandling of Crisis in his Disease-Ravaged Country*, THE INDEPENDENT (LONDON), July 10, 2000, at 11 (explaining the controversy raised by President Mbeki's comments.); Norman Kempster, *Clinton, Mbeki Focus on AIDs During Meeting*, L.A. TIMES, May 28, 2000, at 6 (discussing Mbeki's position on AIDs on a state visit to the White House with Clinton).

197. The promise of biotechnology was recognized by President Bill Clinton when he honored four Monsanto researchers with the National Medal of Technology in 1999. *See* David Stipp, *Is Monsanto's Biotech Worth Less Than a Hill of Beans?*, FORTUNE, Feb. 21, 2000, at 157. Time Magazine devoted a cover story to the potentialities of using genetically modified foods to eliminate world hunger. It provided charts showing the role of genetically modified foods in fighting hunger and the needs of overpopulated countries such as China and India. *See* J. Madeleine Nash, *supra* note 32, at 39-46. Biotechnology has also proved beneficial to farmers growing transgenic papayas, African sweet potatoes, fruits and vegetables that stay fresh for a long time. In Africa the promise of genetically modified organisms include reducing the need for weeding that keeps children from going to school. *Id.* at 46. One of the strongest supporters of genetically modified foods and plants is Gordon Conway, a British ecologist who believes that the technology can be directed at productive activities with clear benefits to human

for feeding the world but also as satisfying specific food needs. With the capacity to design seeds, plants and other agricultural produce with unique attributes or proteins, foods of specific qualities (low fat, high fibre, high protein) and quantities can be produced to meet the needs of society. For instances, through genetic engineering, scientists have developed a new type of rice (golden rice) that contains beta-carotene, the nutrient for Vitamin A.[198] The golden rice is supposed to save the lives of millions of children particularly in developing countries who suffer from Vitamin A deficiency leading to death or blindness.[199] Also, through genetic engineering scientists have been able to develop a new breed of longer lasting and better tasting frost-resistant tomatoes.[200] The potential benefits of agrobiotechnology even extend to the environment. The development of insect- resistant plants and herbicide-ready seeds such as the Round-Up-Ready seeds were intended to reduce, and may be applauded as reducing, the need to use pesticide thereby minimizing the negative impact on the environment.[201]

If agrobiotechnology holds such great promise for society why is there such an uproar over genetic engineering in agriculture? The answer to this might be explored through the experience of one of the major players in the industry, Monsanto. Monsanto is an interesting subject for a case study because it used a deliberate and elaborate corporate strategy to acquire and maintain a dominant position in the biotechnology industry seen by some as a threat to social welfare. Moreover, because of the controversy surrounding the conduct of Monsanto, there has been much commentary on its corporate policies and strategic objectives. These policies and strategic maneuvering have an impact on the concept of property, requiring the analysis that follows.

i. Monsanto and the Corporate Strategy

Monsanto is a Saint Louis based U.S. global biotechnology enterprise that appears to have been caught up in the spins of its own clever strategic maneuvering in the agrobiotechnology sector. Monsanto is a major global player in the seed business. It has been listed among the top ten global agrochemical companies in

---

beings and the environment. He criticized the biotech companies for not using the technology properly or wisely. *See The Voices of Reason in the Global Food Fight*, FORTUNE, Feb. 21, 2000 at 164-72 [hereinafter *Voices of Reason*].

198. Nash, *supra* note 32, at 40-41.

199. *Id.* at 39-41 (discussing the development of the golden rice and its importance to the health of children in developing countries. The genetic engineering involved here was deliberately engaged in to solve the vitamin A deficiency of children in developing countries).

200. *Id.* at 46; *see also* Michela Wrong, *GM May Be a Matter of Seduction*, FIN. TIMES, LIFE SCIENCES, Oct. 28, 1999, at 4 (using Astra Zeneca's genetically modified better tasting and longer lasting tomato as an example of benefits of genetic engineering).

201. *See* Michael Specter, *The Pharmageddon Riddle*, THE NEW YORKER, Apr. 10, 2000, at 60 (discussing the corporate objectives of Monsanto to minimize the environmental impact in the use of genetically modified organisms).

1997 in terms of revenues generated.[202] According to estimates of transgenic crops planted in the United States, Monsanto held a dominant market position with 88% of the market while the next two competitors, Aventis and Novartis, held 8% and 4% respectively.[203] Monsanto appears to have adopted an aggressive corporate strategy which brought it both success and headaches. Monsanto is currently engulfed in a global public relations debacle over the infamous *Terminator Seed* and is also in a patent infringement dispute with a small Canadian farmer over what may be described as "the escaped seed."[204] The reasons these two incidents are indicative of the general problems faced by the biotechnology industry will become obvious later.

The corporate strategy that brought Monsanto to global prominence and, as some might say, "ill fame" has been the subject of much commentary.[205] Indeed, according to one commentator, Monsanto seems to have become a "cauldron of evil"[206] and, one might say, virtually synonymous with all that is bad with genetically modified organisms.[207] One such recent commentary is by Toby E. Stuart of the University of Chicago Business School.[208] According to Stuart, major scientific advances in biotechnology in the 1970s suggested revolutionary changes in the agriculture business.[209] The top management of Monsanto, recognizing the promise of biotechnology, decided to become a major player in it.[210] They selected an aggressive corporate strategy which ultimately transformed the company from a plastics and chemical entity to a biotechnology power house. The strategy involved the formation of over 50 overlapping biotechnology strategic alliances and many acquisitions of companies in the field of biotechnology.[211] Monsanto's strategic structure has been described by Stuart in Figure 1.[212]

---

202. *See The Gene Giants Masters of the Universe?*, RURAL ADVANCEMENT FOUNDATION INTERNATIONAL (RAFI) COMMUNIQUE Mar./Apr. 1999, at 5-6 [hereinafter RAFI COMMUNIQUE].

203. *Id.* at 7.

204. *See infra* Parts IV.D.2.c and IV.D.2.d (discussing the Terminator Seed and escaped seed disputes).

205. Virtually every article addressing the promise or evils of genetically modified organisms discusses the role of Monsanto in the industry. *See generally supra* notes 197 and 201. *See also* Jon R. Luoma, *Pandorsa's Pantry*, MOTHER JONES, Jan./Feb. 2000, 53, 58 (explaining the types of strategic moves Monsanto made in the employment and appointment of former government officials as employees or members of the board of directors thereby creating a chemical bond between Monsanto and policy makers in government).

206. *See* Specter, *supra* note 201, at 62.

207. Not long after President Clinton awarded Monsanto's scientists with the National Medal of Technology, the company came under heavy attack over genetically modified foods. *See generally* Stipp, *supra* note 197.

208. *See* Toby E. Stuart, *Alliances Networks: View from the Hub*, FIN. TIMES, (MASTERING STRATEGY, Part Eight, Nov. 15, 1999), at 4.

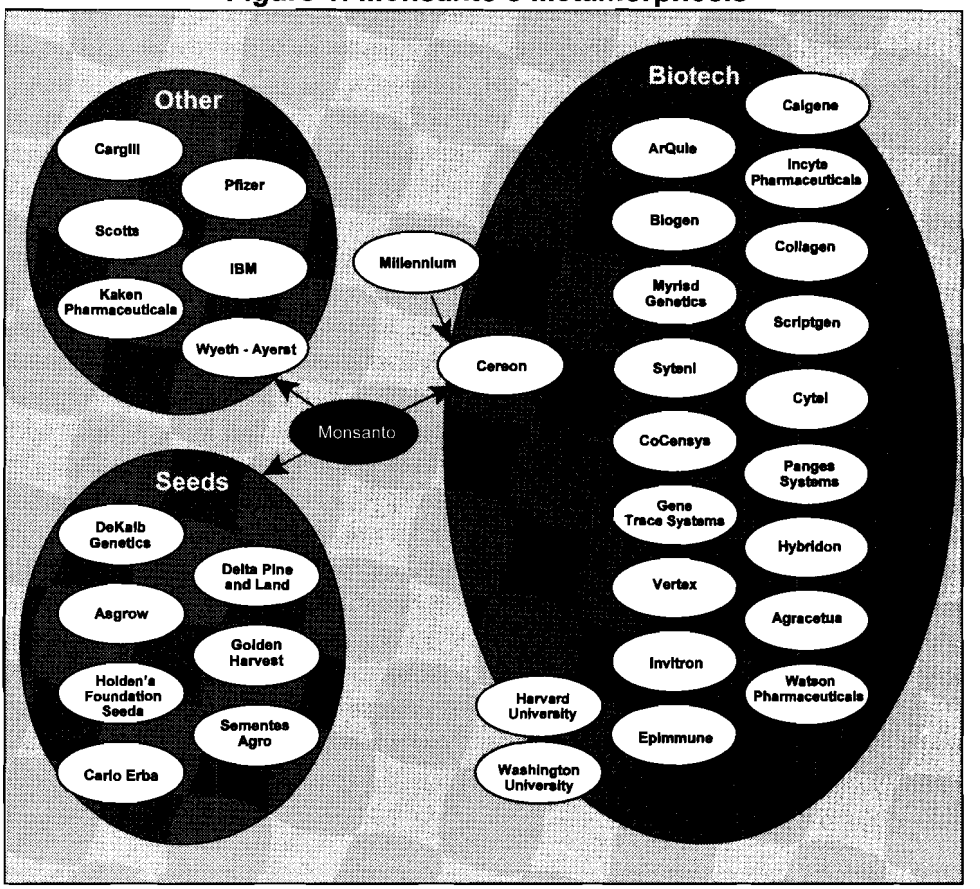
209. *Id.* at 6.

210. *Id.*

211. *Id.*

212. *Id.* at 4. It should be noted that Stuart's article was written to demonstrate the power and the how-to of strategic alliances and collaborations in complex modern business operations. However, the strategy employed by Monsanto is particularly interesting to scholars of property since the strategy has serious implications on the issue of ownership and access to ideas.

Figure 1: Monsanto's Metamorphosis



Source: Toby E. Stuart, *Alliances Networks: View From the Hub*, FIN. TIMES (Mastering Strategy, Part Eight, Nov. 15, 1999), at 4.

As it is apparent from Figure 1, Monsanto employed a spider's web strategy in the formation of its strategic alliances.[213] The spider's web strategy is one in which an enterprise, Monsanto, enters into many alliances with different other entities in the same or many fields of business activities. By so doing, it spins and weaves a wide web or network of collaborations and alliances bringing within its sphere of influence entities and resources outside its internalized domain. What is particularly interesting about Figure 1 is that Monsanto formed overlapping alliances with some of the leading players in biotechnology, seed research, and an assorted variety of

213. The term spider's web was first used in the joint venture context by Steffan Gullander to describe the formation of multiple joint ventures by a single firm, typically a small company. *See* Steffan Gullander, *Joint Ventures and Corporate Strategy*, 11 COLUMBIA J. WORLD BUS. 104, 106 (1976). The term is adopted here to describe the phenomenon of multiple alliances to achieve various corporate objectives.

other areas including major research universities such as Harvard University and Washington University.[214] These alliances provided Monsanto with many advantages: (1) direct access to new ideas and participation in cutting edge research activities; (2) peeping rights; that is, the right to look at the research activities and results of others through a peephole with a powerful telescope; (3) property rights in new inventions; (4) rights to exclusive or non-exclusive licenses; and (5) perhaps even more important, the right to sit at the bargaining table to determine how new biotechnological innovations might be exploited, by whom and under what circumstances. In other words, even though Monsanto might not have been the inventor of a new technology, it might nevertheless have a significant influence on the access to such an invention by others.

With the rights listed above, the spider has more power than its internal or physical resources would indicate. A wide network of alliances provided Monsanto with access to major new scientific ideas in the field and the direction of the biotechnology business. It could then engage in the most appropriate strategic response to emerging technologies. With acquisitions it could take over proven research and development entities such as Calgene, proven technologies such as the Terminator Seed, or acquire those that held the greatest promise.[215] Overlapping alliances in a field allowed Monsanto to associate with, and obtain rights in, the first successful developments in that field; such that it could legally challenge subsequent developments as was the case in the Bt gene controversy with Mycogen.[216] The right to sit at the bargaining table permits Monsanto to influence, if not control access to, and exploitation of, new biotechnology ideas even when it has no proprietary interest in such ideas. For instance, the inventors of the golden rice which contains the nutrients for Vitamin A had planned to put that invention in the public domain for the benefit of children worldwide suffering from Vitamin A deficiency.

---

214. *See* Stuart, *supra* note 208, at 4.

215. Monsanto acquired a controlling interest in Clagene, a plant biotech company, also acquired Agracetus, in 1996, Delta and Pine Company, the joint developer of the Terminator Seed, and entered into many joint ventures with Cereon Genomics, Millium Pharmaceuticals, Synteni, Ecogen, and others. *See generally id.* at 6.

216. *Id.* at 4. In 1996, the Environmental Protection Agency (EPA) approved insect-resistant corn for commercial use. Insect-resistant corn is genetically modified corn capable of producing Bacillus thuringiensis (Bt) pesticidal protein lethal to insects, particularly the European corn borer. Although the Bt toxin is naturally occurring its levels in plants had to be increased to be effective against insects. With the approval of the Bt corn, the market for genetically modified corn seeds increased steadily and it was estimated that by 1999 Bt corn cultivation would be 10 to 20 acres out of 80 acres of corn planted nationwide. With the projected expansion in demand Monsanto and Mycogene found themselves locked in a battle over patent rights in Bt corn. Mycogene brought a patent infringement suit against alleging that two of its Bt toxin patents had been infringed by Monsanto and some of Monsanto's subsidiaries. Monsanto defended against the suit claiming that it had not infringed Mycogene patents and that those patents were invalid. For a full discussion of the dispute and the science of genetic engineering. *See* Mycogene Science Inc. v. Monsanto Company et al., 61 F. Supp 2d. 199 (1999) (holding inter alia that Mycogene patents were invalid); *see also* Monsanto Company v. Mycogene Plant Science Inc., 61 F. Supp. 2d 133 (1999) in which Monsanto claimed that Mycogene, Agrigenetics, and Novartis corporation had infringed another Monsanto Bt patent. However, the court held there was sufficient evidence for the jury to have found that the patent was invalid because prior invention.

However, that plan ran into stiff opposition from Astra Zeneca, an exclusive licensee of one of the genes used by the inventors. A deal was struck giving Astra Zeneca exclusive rights to the invention in developed markets in exchange for it being made available freely to developing countries.[217] Thus, strategic alliances might be the source of market power beyond what could have been obtained through normal ownership of specific inventions.

The strategic posture of Monsanto was redirected in 1995 to give the corporation a *gentler* focus when Robert Shapiro became the Chief Executive Officer (CEO) of Monsanto. Mr. Shapiro is not only a lawyer but also a former professor of law and of urban affairs who saw his position as CEO as an opportunity "to make a difference in the world."[218] According to Specter, the corporate goals of Monsanto were then channeled to help people "lead longer, healthier lives, at costs that they and their nations can afford and without continued environmental degradation."[219] To achieve this goal, Monsanto shed its chemical operations and focused on the biotechnology arena where it developed Roundup- Ready seeds and insect resistant plants to increase yields in agricultural production while concurrently saving the environment.[220] How then could such a noble goal produce such a ruckus

---

217. Madeleine Nash, *Grains of Hope, supra* note 32, at 43 (discussing the goals of the inventors and the criticism the deal with Astra Zeneca attracted).

218. Specter, *supra* note 201, at 64.

219. *Id.* at 60.

220. The shift in the corporate strategy seems to reflect the sensitivity of Mr. Shapiro, the CEO of Monsanto to social and environmental issues. This sensitivity was captured in the following conversation between Shapiro and Specter concerning the reality of the corporate game which Shapiro learnt as general counsel of G.D. Searle. Specter states:

> He learned that [reality of the corporate game] in 1982, when he became the head of the NutraSweet operation at Searle. 'One of the moments in my evolution that I will always remember is after we had launched the product, and I was feeling really good because it seemed to be succeeding,' he said. 'It was the first business I'd ever been given a chance to try to create, and it was working well. So I was feeling proud of myself. But then I began getting letters from kids and from parents of kids, mostly diabetics, who had never before been able to have something like Kool-Aid or Jell-O. And I realized what was going on. *We were doing something important for people. It wasn't just making a handheld calculator, as we had done in my previous incarnation. This thing actually mattered.'*
>
> 'That did it for me,' he continued. 'I mean, look, I am very well compensated and I like that. It's nice to have some of the perks that make life easier. It is even nice when you talk with people that they probably laugh at your jokes more than you deserve because of who you are. But the thing *I never would have guessed about this job is that it gives you a chance to make a difference in the world.* When you go home at night and you talk to your family about what you're working on, it isn't like 'Gee, I designed a really cool paper clip today.' It's about the earth, it's about the environment, it's about food. It's about health and nutrition. Those are deep, ancient things for civilization, and they are for the people.'
>
> At that point, Shapiro stopped talking, because he was fighting back tears. It was our first meeting, and I wondered if this reserved and powerful corporate leader was acting. After a few moments, he apologized. 'You asked me before how this makes me feel,' he said, referring to the very personal opposition that he and Monsanto face almost every day. 'There are two things that most of us feel. We feel hurt, and we feel angry.' Later, he added to that: 'We were really proud to get out front the way we

and such disastrous consequences for Monsanto? The simple answer may be that *good thoughts do not always translate into good deeds.* However, the answer to this question is necessarily much more complex and a full discussion of it is outside the scope of this Article. We shall, however, focus on those aspects of the answer that relate to the task at hand: the implications of Monsanto's strategic moves on ownership and access to ideas in biotechnology. In particular, we shall address below the implications of conferring property rights over the Terminator Seed technology and the property implications of the "escaped seed" dispute.

ii. Monsanto and the Terminator Seed Controversy

In 1998, the United States Patent and Trademark Office (U.S. PTO) granted a patent (Patent No. 5,723,765) to the United States Department of Agriculture Research Services and Delta and Pine Land Corporation (Delta), a Mississippi corporation and a major breeder of cotton and soybean.[221] Although the patented invention was described by its developers as the "Technology Protection System," it was later dubbed by its critics as the "Terminator Seed."[222] To critics the term "terminator" appeared appropriate because the invention involved a genetically modified seed that would produce sterile offspring.[223] The seed sterilizing technology is guaranteed by its developers to work in cotton and tobacco and is also believed to work in wheat, rice and soybeans.[224] A few months after the grant of the terminator patent, Monsanto acquired Delta and Pine Land Co. for about $1.9 billion and thereby obtained the patent rights in the terminator technology.[225]

The public outcry against the Terminator Seed technology and all it stood for was first mounted against the USDA but was shifted to Monsanto after its

---

did'—with biotechnology. 'In retrospect, it seems incredibly naive, but it's the truth. We had real leadership; we had worked hard to do it. We had shown faith in this science when others were dubious. . . .' *See* Specter, *supra* note 191, at 64. (emphasis added).

221. *See* Lance Nixon, *New Technology Would Help Seed Companies Protect Research Investments,* KNIGHT-RIDDER TRIB. BUS. NEWS, Aug. 8, 1999 (presenting various arguments for and against the Terminator Seed technology); Richard A. Steinbrecher & Pat Roy Mooney, *Terminator Technology: The Threat to World Food Security,* 28 THE ECOLOGIST, Sept./Oct. 1998 (arguing the dangers presented by the Terminator Seed technology to society, and in particular, farmers).

222. The Terminator Seed technology attracted two competing characterizations that explain perceptions of its benefits and dangers. Proponents of the technology describe it as a built-in patent protection system designed to protect U.S. seed innovators from foreign licensees. *See generally* Jeffrey Kluger, *The Suicide Seeds,* 153, THE ENV'T, Feb. 1, 1999; Steinbrecher & Mooney, *supra* note 221. Some even go so far as to say that it will provide protection against genetic pollution in that the seeds of any affected plants will not germinate thereby stopping the spread of contaminated seeds. *See* Nixon, *supra* note 221. However, in 1998, RAFI identified the "Technology Protection System" patent and gave it the popular name "Terminator." Later it described the Terminator Seed technology as the traitor technology. *See* RAFI COMMUNIQUE, *supra* note 202, at 8. The name Terminator has since taken hold on the technology.

223. RAFI COMMUNIQUE, *supra* note 202.

224. *Sowing Seeds of Discontent,* ST. LOUIS POST-DISPATCH, Nov. 13, 1998.

225. *Id.*